DEVELOPMENT OF MINI-RESEARCH PROJECT MODULE AND ITS EFFECT ON ENGLISH TECHNICAL WRITING COMPETENCE AMONG ENGINEERING STUDENTS IN MALAYSIAN POLYTECHNICS

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SULTAN IDRIS EDUCATION UNIVERSITY

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APPRECIATION

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ABSTRACT

The engineering industry has recommended that Malaysian polytechnic engineering students improve their English Technical writing skills before they graduate. Thus, this research aimed to develop a Mini-Research Project (MRP) Module and examine its effect on English Technical writing competence in terms of knowledge, skills, and attitudes among engineering students in Malaysian polytechnics. The MRP Module was developed based on the adaptation of several theories and models, including ADDIE (Analysis, Design, Development, Implementation, Evaluation) Instructional Design Model, Cognitive Process of Writing Theory, Canale and Swain of Communicative Competence Theory and Model, and Model of Technical Writing Domains. This study involved 134 engineering students from two conventional polytechnics in Malaysia, selected using multistage random sampling. The 134 subjects were selected from four classes which comprised two experimental groups and two control groups. The main effect of the MRP Module was mainly measured quantitatively using a pre-post-test design. Inferential statistics used included Paired-sample T-test, One-way ANCOVA, and Two-way between-groups ANOVA. However, the effects of using the MRP Module on the attitude aspect were measured quantitatively using descriptive statistical analysis and students' attitudes were also measured qualitatively using Braun and Clarke thematic analysis. The results revealed significant effects in experimental group students on their knowledge, skills, and attitudes in English Technical writing after using the MRP module. In conclusion, the usage of the MRP Module has improved students' English Technical writing competence. Hence, this study proposes to use the MRP Module in the teaching and learning Communicative English Course to the Curriculum Division of Malaysian Polytechnic Education. Possessing English Technical writing competence is an advantage to the engineering students, as it is one of the leading employability attributes by the engineering industry.

PEMBANGUNAN MODUL MINI-RESEARCH PROJECT DAN KESANNYA KE ATAS KOMPETENSI PENULISAN BAHASA INGGERIS TEKNIKAL DALAM KALANGAN PELAJAR KEJURUTERAAN DI POLITEKNIK-POLITEKNIK MALAYSIA

ABSTRAK

Industri dalam bidang kejuruteraan mengesyorkan agar pelajar-pelajar jurusan kejuruteraan di politeknik dapat meningkatkan kemahiran penulisan Bahasa Inggeris Teknikal sebelum mereka bergraduasi. Justeru, kajian ini bertujuan untuk membina Modul Mini-Research Project (MRP) dan menguji kesan penggunaannya ke atas kompetensi penulisan Bahasa Inggeris Teknikal dalam aspek pengetahuan, kemahiran, dan sikap pelajar-pelajar kejuruteraan di politeknik-politeknik Malaysia. Modul MRP yang digunakan dalam kajian ini telah dibina dengan mengadaptasi beberapa teori dan model seperti Model Rekabentuk Instruksi ADDIE (Analysis, Design, Development, Implementation, Evaluation), Teori Proses Kognitif Penulisan, Teori dan Model Kompetensi Komunikasi Canale dan Swain, dan Model Domain Penulisan Teknikal. Dua buah politeknik konvensional di Semenanjung Malaysia telah dipilih secara rawak pelbagai lapis. Seramai 134 pelajar dalam jurusan kejuruteraan dari empat buah kelas telah terpilih sebagai dua kelas untuk kumpulan rawatan dan dua kelas untuk kumpulan kawalan. Kesan utama penggunaan Modul MRP telah diukur secara kuantitatif menggunakan rekabentuk ujian pra dan pasca. Analisa data menggunakan statistik inferensi yang digunakan melibatkan Paired-sample T-test, One-way ANCOVA, dan Two-way between-groups ANOVA. Manakala kesan penggunaan Modul MRP dalam aspek sikap telah diukur secara kuantitatif menggunakan analisa data statistik deskriptif dan sikap mereka juga telah diukur secara kualitatif menggunakan teknik analisa tema oleh Braun dan Clarke. Keputusan kajian menunjukkan terdapat kesan yang positif terhadap aspek pengetahuan, kemahiran, dan sikap pelajar kumpulan rawatan dalam penulisan Bahasa Inggeris Teknikal selepas menggunakan Modul MRP. Sebagai kesimpulan, penggunaan Modul MRP telah berjaya meningkatkan kompetensi penulisan Bahasa Inggeris Teknikal pelajar-pelajar. Justeru, kajian ini mencadangkan kepada Bahagian Kurikulum Politeknik Malaysia agar Modul MRP dapat digunakan dalam pengajaran dan pembelajaran Kursus Bahasa Inggeris Komunikasi. Para pelajar kejuruteraan yang memiliki kemahiran penulisan Bahasa Inggeris Teknikal memperoleh satu kelebihan kerana kemahiran ini menjadi salah satu faktor utama dalam pemilihan pekerja oleh industri kejuruteraan.

CONTENTS

		Page
DECLARATION OF ORIGINAL WORK		ii
DECLARATION OF THESIS		iii
APPRECIATION		iv
ABSTRACT		v
ABSTRAK		vi
CONTENTS		vii
LIST OF TABLES		xiv
LIST OF FIGURES		xxii
LIST OF ABBREVIATIONS		xxiv
LIST OF APPENDICES		xxv
CHAPTER 1 INTRODUCTION		
1.1	Background of the Study	3
1.2	Statement of the Problem	21
1.3	Purpose and Objectives of the Study	23
1.4	Research Questions	24
1.5	Null Hyphotheses	26
1.6	Conceptual Framework	27
1.7	Operational Definition	31
1.8	Scope of the Study	35
1.9	Limitations of the Study	36
1.10	Significance of the Study	38
1.11	Summary of the Chapter	41

CHAPTER 2 LITERATURE REVIEW

2.1	Introduction	42
2.2	Theoretical Concepts and Models of Communicative Competence	43
2.2.1	Canale and Swain's Communicative Competence Model	45
2.2.2	Farhady's Communicative Competence Model	46
2.2.3	Bachman's Communicative Competence Model	46
2.2.4	Celce-Murcia' Communicative Comptence Model	47
2.2.5	Communicative Competence in English Language	48
2.3	Learning Theory and Cognitive Process Theory of Writing	51
2.3.1	Cognitive Learning	52
2.3.2	Cogitive Process Teory of Writing	55
2.4	Theoretical Concepts of Communication, Models of Communication, Technical Writing and the Models of Technical Writing Domains	58
2.4.1	Theoretical Orientation of Technical Writing	61
2.4.2	Models of Technical Writing Domains	64
2.5	The Importance of Technical Writing	70
2.5.1	Engineering Education in Malaysia	74
2.5.2	Technical Writing for Engineering Students	75
2.5.3	Technical Communication Attributes in Employability Skills Expected by Employers	81
2.5.4	Technical Communication Skills at Polytechnics in Malaysia	84

2.6 Writing Competency as an Essential Skill in Education 87

2.6.1 Attitudes toward Writing, Gender Differences, Writing Apprehension and Writing Anxiety 88

2.6.2 Socio-Economic Status and Writing Self-Efficacy 90

2.6.3 English Language Proficiency and Writing Startegy 91

2.7 Concept of Module 97

2.7.1 Types, Characteristics and Components of Module 98

2.7.2 Effects of Using Module in Teaching and Learning 101

2.8 Instructional Design Theory and Models 102

2.8.1 ADDIE Instructional Design Model 103

2.8.2 Dick and Carey Instructional Design Model 104

2.8.3 Kemp, Morisson and Ross Instructional Design Model 105

2.8.4 Application of ADDIE Model in Designing and Developing Module as Instructional Materials 106

2.9 Summary of the Chapter 108

CHAPTER 3 RESEARCH METHODOLOGY

3.1 Introduction 109

3.2 Research Design 110

3.3 Population and Sample 118

3.4 Procedure of Data Collection 123

3.5 Threats to Validity 127

3.5.1 Threats to Internal Validity 127

3.5.2 Threats to External Validity 129

3.6	Variable of the Study	131
3.7	Instrumentation	131
3.7.1	Validity form for Mini-Research Project Module	132
3.7.2	Questionnaire on MRP Module Reliability	133
3.7.3	Pre/Post-Test	134
3.7.4	Questionnaire on Students' Perception on the Effects of MRP Module on Technical Writing Competence	137
3.7.5	Focus Group Interview Protocol	138
3.8	Pilot Study	142
3.9	Validity Testing of Research Instruments	143
3.9.1	Validity Testing of Pre-Post-Test from Expert Evaluation	145
3.9.2	Validity Testing of Questionnaire on Students' Perspectives on the Effects of MRP Module on Technical Writing Competence based on Experts' Evaluation	147
3.9.3	Validity Testing for Interview Protocols of Effects on Students' Attitudes after using MRP Module	148
3.10	Reliability Testing of Research Instruments	150
3.10.1	Reliability testing of Pre/Post-Test	152
3.10.2	Test-Retest Reliability	157
3.10.3	Realiability Testing of Questionnaire on Effects of MRP Module on English Technical Writing Competence	158
3.10.4	Realiability Testing of Interview Protocols	159

3.11 Data Analysis Procedure 160

3.11.1 Procedure of Quantitative Data Analysis 160

3.11.2 Procedure of Qualitative Data Analysis 166

3.12 Summary of the Chapter 167

CHAPTER 4 DESIGN AND DEVELOPMENT OF MODULE

4.1 Introduction 168

4.2 Analysis 170

4.3 Design and Development of the Module 194

4.4 Validity and Reliability 208

4.5 Validity Testing of MRP Module Based on Expert Evaluation 209

4.6 Reliability Testing of MRP Module 214

4.7 Implementation 216

4.8 Evaluation 219

4.9 Summary of the Chapter 226

CHAPTER 5 RESEARCH FINDINGS

5.1 Introduction 227

5.2 Respondent Profile 228

5.3 Descriptive Analysis of Pre-Test Findings 231

5.4 Normality Test of Pre-Test Data 232

5.5 Analysis for Homogeneity of Variance Test of Pre-Test Data 233

5.6 Analysis of Comparison for Mean Scores 236

5.7 Normality Test of Post-Test Data 238

5.8 Analysis for Homogeneity of Variance Test of Post-Test Data 240

5.9 Analysis of Braver and Braver 241

5.9.1 Two-way ANOVA Test Analysis 241

5.10 Null Hypotheses Testing 249

5.10.1 Hypothesis 1 250

5.10.2 Hypothesis 2 253

5.10.3 Hypothesis 3 256

5.10.4 Hypothesis 4 261

5.10.5 Hypothesis 5 265

5.10.6 Hypothesis 6 268

5.10.7 Hypothesis 7 273

5.10.8 Hypothesis 8 277

5.10.9 Hypothesis 9 281

5.10.10 Hypothesis 10 285

5.10.11 Hypothesis 11 290

5.10.12 Hypothesis 12 294

5.11 Analysis Descriptive Statistics for Questionnaire on Students' Perceptions on the Effects of MRP Module on Attitudes towards Writing in English. 302

5.12 Data Triangulation 305

5.12.1 Qualitative Analysis for Interview Protocol 305

5.13 Summary of the Chapter 311

CHAPTER 6 DISCUSSION, CONCLUSION AND RECOMMENDATIONS

6.1 Introduction 312

6.2 Summary of Study 313

6.3 Discussions of the Findings 313

6.4 Implications of the Study 322

6.5 Conclusion and Recommendations 328

REFERENCES 331

APPENDICES 351

LIST OF TABLES

Table No.		Page
2.1	Communicative Competency Models and their Components	50
2.2	Four Categories of Main Types of Documents in Technical Writing	64
2.3	Analysis of Technical Writing Domains from Various Models in Related Literature	67
2.4	The Most Technical Writing Domains used by Previous Literature from 2001-2018	69
2.5	Domains of Technical Writing Selected in Technical Writing Competence of the Study	70
2.6	Differences between Technical Writing, General Academic Writing, and Creative Writing	76
2.7	Three Premier Attributes Expected by Employers	82
2.8	Ten Premier Transferable Skills and their Associated Elements	83
2.9	Polytechnic Students' Learning Domain	87
3.1	Types of Experimental Research Design	112
3.2	Pre-post-test Experimental Research Design	114
3.3	Solomon Four-Group Experimental Research Design	115
3.4	Four-Group Quasi-Experimental Research Design	117
3.5	2 x 2 Factorial Analysis of Post-Test Mean Scores	118
3.6	Population of Semester 4 Engineering Students at Conventional Polytechnics, Peninsular Malaysia	119
3.7	Threats to Internal Validity and Steps to Control	128
3.8	Threats to External Validity and Steps to Control	130
3.9	Types of Validity	144
3.10	Validity Values of Pre/Post-Test Instrument for Measuring Knowledge and Skills of Polytechnic Engineering Students Based on Experts' Evaluation	146

3.11	Validity Values on Items in Questionnaire on Students' Perspectives on the Effects of MRP Module on Technical Writing Competence Based on Expert's Evaluation	147
3.12	Analysis of Feedback for Interview Protocols on Students' Attitudes after Using MRP Module from Lecturers' Views	149
3.13	Point-Biserial Correlation and Index for Discrimination Item	153
3.14.1	Items of True or False	154
3.14.2	Level of Item Difficulty, Standard Difficulty Index and, Indicator of Difficulty Index	156
3.14.3	Analysis of Item Difficulty of Pre/Post-Test	157
3.14.4	Pilot Test of Pre/Post-Test Experimental Design	158
3.15	Reliability Test for Questionnaire on Effects of MRP Module	159
3.16	Statistical Tests and Statistics Frequently Used in Educational Research and Criteria for Choosing the Statistics for Hypothesis Testing	162
3.17	Research Matrix of Quantitative and Qualitative Data Analysis	162
4.1	List of polytechnics involved in pilot study	173
4.2	Table for Determining Sample Size	180
4.3	Students' Perceive on the Needs of English Technical Writing Knowledge	182
4.3.1	Students' Perceive on the Needs of English Technical Writing Skills	184
4.4	Students' Perceive on Their Attitudes toward English Writing Technical Tasks	185
4.5	Lecturers' Perceive on Students' Needs of English Technical Writing Knowledge	186
4.6	Lecturers' Perceive on Students' Needs of Skills in English Technical Writing	188
4.7	Lecturers' Perceive on their Attitudes toward English Technical Writing Tasks	190

4.8	Thematic Analysis Concerning the Content of Current Module Sufficiency in Communicative English Course to Carry out Mini-Research Project	191
4.9	Summary of Thematic Analysis Regarding the Present Module of Communicative English Course Consists of Sufficient Written Exercises to Write the Mini Project Report	193
4.10	Summary of Thematic Analysis Regarding Introducing a New Module on Writing a Project Report in English to Polytechnic Students	194
4.11	Domains of Technical Writing in Mini-Research Project Module	201
4.12	Contents of Unit 1 of Mini-Research Project (MRP) Module	202
4.13	Contents of Unit 2 of Mini-Research Project (MRP) Module	203
4.14	Contents of Unit 3 of Mini-Research Project (MRP) Module	204
4.15	Contents of Unit 4 of Mini-Research Project (MRP) Module	205
4.16	Contents of Unit 5 of Mini-Research Project (MRP) Module	207
4.17	Contents of Unit 6 of Mini-Research Project (MRP) Module	208
4.18	Content Validity Value on Session and Activity for Mini-Research Project (MRP) Module Based on Experts' Review	211
4.19	Content Validity Value for Mini Research Project (MRP) Module Based on Experts' Review	213
4.20	Reliability Index for Unit and Activity of MRP Module	215
4.21	Summary of summative assessment comprises in the Mini-Research Project (MRP) Module	220
5.1	Respondent Profile According to Group	230
5.2	Descriptive Statistics of Pre-Test Mean Scores for Knowledge and Skills in Technical Writing of Experimental Group (E1) and Control Group (C1)	231
5.3	Test of Normality for Pre-Test Data of Knowledge and Skills in English Technical Writing	233
5.4	Levene's Test for Homogeneity of Variances Assumptions on Pre-Test Mean Score for Knowledge in Technical Writing	235

5.5	Levene's Test for Homogeneity of Variances Assumptions on Pre-Test Mean Score for Skills in Technical Writing	236
5.6	Analysis of Independent Sample T-Test for Pre-Test Mean Scores of Knowledge in Technical Writing between Experimental Groups and Control Groups	237
5.6.1	Independent Sample T-Test Analysis of Pre-Test Result for Skills in English Technical Writing between Experimental Groups and Control Groups	238
5.7	Test of Normality for Post-Test Mean Score of Knowledge in Technical Writing	238
5.7.1	Test of Normality for Post-Test Mean Score of Skills in Technical Writing	238
5.8	Levene's Test for Homogeneity of Variances on Post-Test Mean Score of Knowledge in Technical Writing	240
5.81	Levene's Test for Homogeneity of Variances on Post-Test Mean Score of Skills in English Technical Writing	241
5.9	2 x 2 ANOVA Analysis of Post-Test Mean Score in Technical Writing Competence	242
5.9.1	Analysis of Pre-Test and Treatment Effects on Knowledge in Technical Writing of Post Test Data	243
5.9.2	Analysis of Simple Main Effects Using Turkey Post Hoc Test between Groups with Pre-Test (E1 & C1) and Groups without Given Pre-Test (E2 & C2) on Knowledge in Technical Writing	244
5.9.3	Analysis of Simple Main Effects Using Turkey Post Hoc Test between Groups with Given Treatment (E1 & E2) and Groups without Given Treatment (C1 & C2) on Knowledge in Technical Writing	245
5.9.4	Analysis of Pre-Test and Treatment Effects on Skills in Technical Writing of Post-Test Mean Score Data	247
5.9.5	Analysis of Simple Main Effects Using Turkey Post Hoc Test between Groups which Were Given Pre-Test (E1 & C1) with Groups without Given Pre-Test (E2 & C2) on Skills in English Technical Writing	248
5.9.6	Analysis of Simple Main Effects Using Turkey Post Hoc Test between Groups which Were Given Treatment (E1 & E2) with Groups without Given Treatment (C1 & C2) on Skills in TW	249

5.10.1	Analysis of Comparison between Pre-Test and Post-Test Mean Scores in Experimental Group (E1) Using Descriptive Analysis	251
5.10.2	Analysis of Normality Test of Different Total Mean Score of the Pre-Test and Post-Test on Knowledge in Technical Writing for Experimental Group (E1)	252
5.10.2b	Analysis of Paired-Sample T-Test for Pre-Test and Post-Test Mean Scores on Knowledge in Technical Writing of Experimental Group (E1)	253
5.10.2.1	Analysis of the Difference between Pre-Test and Post-Test Mean Scores of Control Group (C1) Using Descriptive Analysis	254
5.10.2.2	Analysis of Normality Test of Different Total Mean Score between Pre-Test and Post-Test of Knowledge in Technical Writing in Control Group (C1)	255
5.10.2.3	Analysis of Paired-Sample T-Test of Pre-Test and Post-Test Mean Scores of Knowledge in Technical Writing of Control Group (C1)	256
5.10.3.1	Analysis of Normality Test of Post-Test Mean Scores on Knowledge in English Technical Writing between Control Group and Experimental Groups	257
5.10.3.2	Levene's Test for Homogeneity of Variances on Post-Test Mean Score of Knowledge in English Technical Writing as Dependent Variable	258
5.10.3.3	Analysis of One-Way ANCOVA Test between Subjects Effects on Post-Test after Controlling the Effect of Pre-Test	259
5.10.3.4	Analysis of Descriptive Statistics of Unadjusted and Adjusted Post-Test Mean Score after Controlling for Pre-Test Mean Score	260
5.10.3.5	Analysis of Multiple Comparison Using Post Hoc Test between Groups on Post-Test Adjusted Mean Score on Knowledge in Technical Writing	261
5.10.4.1	Analysis of Comparison between Pre-Test and Post-Test Mean Scores in Experimental Group (E1) Using Descriptive Analysis	262
5.10.4.2	Analysis of Normality Test of Different Total Mean Score of Pre-Test and Post-Test of Skills in Technical Writing of Experimental Group (E1)	263

5.10.4.3	Analysis of Paired-Sample T-Test for Pre-Test and Post-Test Mean Scores of Skills in Technical Writing of Experimental Group (E1)	265
5.10.5.1	Analysis of the Difference between Pre-Test and Post-Test Mean Scores of Control Group (C1) Using Descriptive Analysis	266
5.10.5.2	Analysis of Normality Test of Different Total Mean Score between Pre-Test and Post-Test of Knowledge in Technical Writing of Control Group (C1)	267
5.10.5.3	Analysis of Paired-Sample T-Test for Pre-Test and Post-Test Mean Scores on Skills in Technical Writing of Control Group (C1)	268
5.10.6.1	Analysis of Normality Test of Post-Test Mean Scores on Skills in Technical Writing between Control Group and Experimental Groups	269
5.10.6.2	Levene's Test for Homogeneity of Variances on Post-Test Mean Score of Skills in Technical Writing as Dependent Variable	270
5.10.6.3	Analysis of One-Way ANCOVA Test between Subjects Effects on Post-Test after Controlling the Effect of Pre-Test	271
5.10.6.4	Analysis of Descriptive Statistics of Unadjusted and Adjusted Post-Test Mean Score after Controlling for Pre-Test Mean Score	272
5.10.6.5	Analysis of Multiple Comparison Using Post Hoc Test between Groups on Post-Test Adjusted Mean Score on Skills in Technical Writing	273
5.10.7.1	Analysis of Homoscedasticity of Dependent Variables	274
5.10.7.2	Analysis of Normality Test of Post-Test Mean Scores on Skills in Technical Writing between Experimental Groups (E1 & E2) and Male and Female Students	275
5.10.7.3	Analysis of Levene's Test of Equality of Error Variances	276
5.10.7.4	Analysis of a Two-Way Between-Groups ANOVA of the Effect between Experimental Groups and Gender of Post-Test Score on Knowledge in Technical Writing	277
5.10.8.1	Analysis of Homoscedasticity of Dependent Variables	278

5.10.8.2	Analysis of Normality Test of Post-Test Mean Scores on Skills in Technical Writing between Experimental Groups (E1 & E2) and Male and Female Students	279
5.10.8.3	Analysis of Levene's Test of Equality of Error Variances	280
5.10.8.4	Analysis of a Two-Way Between-Groups ANOVA of the Effect between Experimental Groups and Gender of Post-Test Score on Skills in Technical Writing	281
5.10.9.1	Descriptive Analysis for Homoscedasticity of Dependent Variables	282
5.10.9.2	Analysis of Levene's Test of Equality of Error Variances	283
5.10.9.3	Analysis of a Two-Way between-Groups ANOVA of the Effect between Experimental Groups and SES of Post-Test Score on Knowledge in Technical Writing	285
5.10.10.1	Descriptive Analysis for Homoscedasticity of Dependent Variables	286
5.10.10.2	Analysis of Normality Test of Post-Test Mean Scores on Skills in Technical Writing between Experimental Groups (E1 & E2) and SES	287
5.10.10.3	Analysis of Levene's Test of Equality of Error Variances	288
5.10.10.4	Analysis of a Two-Way between-Groups ANOVA of the Effect between Experimental Groups and SES of Post-Test Score on Skills in Technical Writing	289
5.10.11.1	Descriptive Analysis for Homoscedasticity of Dependent Variables	291
5.10.11.2	Analysis of Levene's Test of Equality of Error Variances	292
5.10.11.3	Analysis of a Two-Way between Groups ANOVA of the Effect between Experimental Groups and English Language Proficiency Level on Post-Test Score of Knowledge in Technical Writing	293
5.10.11.4	Analysis of Post-Hoc Comparison between English Language Proficiency Level Groups	294
5.10.12.1	Descriptive Analysis of Homoscedasticity for Dependent Variables	296
5.10.12.2	Analysis of Levene's Test of Equality of Error Variances	298

5.10.12.3	Analysis of a Two-Way between Groups ANOVA for the Effect of between Experimental Groups and English Language Proficiency Level on Post-Test Score of Skills in Technical Writing	299
5.10.12.4	Analysis of Post-Hoc Comparison between English Language Proficiency Level Groups	300
5.10.12.5	Analysis of a Two-Way between Groups ANOVA of the Effect between Experimental Groups and English Language Proficiency Level of Post-Test Score on Skills in Technical Writing	301
5.10.12.6	Analysis of Post-Hoc Comparison between English Language Proficiency Level Groups	302
5.11	Mean Scores on the Effect of MRP Module on Technical Writing Competence in Terms of Attitude towards Writing Project Report in English among Engineering Students in Malaysian Polytechnics	303
5.12.1	Summary of Thematic Analysis on Students' Perceptions on the Effects of Using MRP Module on Attitudes toward Writing in English in Terms of Feelings	307
5.12.2	Summary of Thematic Analysis on Students' Perceptions on the Effects of Using MRP Module on Attitudes toward Writing in English in Terms of Awareness	308
5.12.3	Summary of Thematic Analysis on Confidence to Use English in Technical Writing	310

LIST OF FIGURES

No. of Figures		Page
1.1	Conceptual Framework of the Study	30
2.1	Structure of a Writing Model	56
2.1.1	Taxonomy of Technical Writing	62
2.2	Updated version of Montgomery's Taxonomy of Technical Writing	63
2.2.1	ADDIE Instructional Design Model	104
2.3	Dick and Carey Instructional Design Model	105
2.4	Kemp's Instructional Design Model	106
3.1	Flow Chart of Multistage Random Sampling Technique	122
3.2	Flow Chart of Data Collection Procedure	125
3.3	Flow Chart of Experimental Research on Teaching Mini Project Using MRP Module	126
3.4	Flow chart of the steps of the focus group interview technique	141
4.1	Flow chart of ADDIE Model phases and activities in developing the Mini-Research Project Module	170
4.2.1	General Objectives of Mini-Research Project Module	196
4.2.2	Steps in Lesson Plan for Conducting Session 1 of Mini-Research Project Module	197
4.2.3	Formula to Calculate the Degree of Content Validity of a Module	209
4.3	Flow Chart of Implementation the Mini-Research Project Module	218
4.4	Section A on a fraction of formative assessment of the MRP Module	222
4.5	Section B on a fraction of formative assessment of the MRP Module	223

4.6	Section C on a fraction of formative assessment of the MRP Module	224
4.7	Section D on a fraction of formative assessment of the MRP Module	225
5.1	Histogram Graph of Normal Curve Distribution for Different Total Score between Pre-Test and Post-Test Mean Score of Skills in Technical Writing in Experimental Group (E1)	264
5.2	Histogram of Normal Curve Distribution of Post-Test Mean Score on Skills in Technical Writing in Experimental Groups (E1 & E2)	297

LIST OF ABBREVIATIONS

ABET	Accreditation Board for Engineering and Technology
ADDIE	Analysis, Design, Development, Implementation and Evaluation
BEM	Board of Engineers Malaysia
DPE	Department of Polytechnic Education
EAB	Engineering Accreditation Board
HKIE	Hong Kong Institution of Engineers
IES	Institution of Engineers Singapore
IESL	Institution of Engineers of Sri Lanka
IR 4.0	4.0 Industrial Revolution
MBOT	Malaysia Board of Technologist
MEB	Malaysia Education Blueprint
MoE	Ministry of Education
MoHE	Ministry of Higher Education Malaysia
MRP	Mini-Research Project
TVET	Technical and Vocational Education Training

LIST OF APPENDICES

A	Application Letter to the Department of Polytechnic Education Malaysia
B	Permission Letter from the Department of Polytechnic Education Malaysia
C	Mini-Research Project (MRP) Module
D	Content Validation Form of Mini-Research Project (MRP) Module
E	Reliability Questionnaire on Mini-Research Project (MRP) Module
F	Pre/Post-Test
G	Questionnaires on the Effects of using Mini-Research Project (MRP) Module
H	Interview Protocol on the Effects of using Mini-Research Project (MRP) Module
I	Lesson Plans for Teaching and Learning Sessions using Mini-Research Project (MRP) Module (sample: Session 2 and Session 3)
J	Appointment Letter to Content Expert (sample)
K	Check-list Activity for Close Reading of Interview Protocol

CHAPTER 1

INTRODUCTION

1.0 Introduction

Effective use and adequate content of any instructional materials could enhance the ability of students to achieve specific learning objectives of a subject. The ability to achieve the learning objectives may derive students from possessing specifically required competency in an education programme. Effectively using instructional material could enhance students' learning outcomes and bring intended changes of attitude (Koko, 2016). Hence, supplying effective material to stimulate learning has highlighted the importance of using effective instructional materials in teaching and learning activities at any educational institution (Koko, 2015). In contrast, the lack of effective and adequate instructional material could cause a crucial impact that limits the knowledge and skills gained by the students. For example, in Addis Ababa University, Ethiopia, research was conducted to investigate why graduates did not perform

appropriately in their professional careers. The research concerned higher education systems inputs related to the instructional materials and outputs, such as the skills and competencies transferred to perform professional tasks. As a result, the negative impacts of inadequate instructional materials used, which supposedly provide knowledge, accounted for more than 50%. The negative impacts of incompetence in performing tasks at the working places which relate skills supposedly attained accounted for approximately 70% (Edessa, 2016). The phenomenon indicated that graduates would be unproductive and incompetent if they failed to receive adequate and effective instructional materials in the education system they had undergone. Not to mention, the scenarios above had globally happened, including in the system of polytechnic education in Malaysia. Therefore, this study intends to develop a new module as instructional material on English technical writing competence and examine the effects of using the module among polytechnic engineering students in Malaysia by employing a quasi-experimental research design (pre/post-test). The elements of competency in this study emphasise three aspects of competence: knowledge, skills, and attitudes towards English technical writing as a communication tool. Coherently, effective communication can significantly impact the quality of work produced in any organisation by working together and interacting with individuals to attain the organisation's aims.

This chapter starts with an introduction as an overview of the research study, which describes the context of the research included in the background of the study. Afterwards, the researcher explains the problem statement, the purpose and the research objectives, the research questions and null hypotheses, the conceptual framework, the operational definition of the terms used in this study that all direct the study. This is

followed by the limitations of the study, the significance of the study, and lastly, the summary of this chapter.

1.1 Background of the Study

The Ministry of Education Malaysia has designed Malaysia Education Blueprint (MEB) 2015-2025 (Ministry of Education Malaysia, 2016). The focus of MEB is to redesign the Ministry of Education Malaysia system, which aims to transform Malaysia's education system by equipping students holistically to enable them to succeed in the 21st century with all the upcoming challenges and changes in the new era. Thus, our education system must develop Malaysian youth who are knowledgeable, creatively, and critically thinking and capable of communicating globally (MEB, 2016). Therefore, Malaysian students have to compete internationally, whereby at one angle towards achieving the goal, our students should communicate effectively in the English language.

As specified in the MEB, effective communication is among the focuses on issues raised. For example, students in tertiary education need to develop communication skills that are used in the workplace (Bhattacharyya, 2018). Parallel to that, the technical education sector, together with the technology industry globally, has recognised and acknowledged effective communication skills as an essential skill to possess by the engineering students before seeking employment (Engineering Technology Accreditation Council (ETAC), 2020; Masadliahani & Normah, (2020); UK Standard for Professional Engineering Competence (UK-SPEC), 2020;

Accreditation Board for Engineering & Technology (ABET), 2019; Malaysia Board of Technologist (MBOT), 2019; Institution of Engineers Singapore (IES), 2018; Lenard & Pintarić, 2018; Pandiyan, 2017; Hong Kong Institution of Engineers (HKIE), 2015; Institution of Engineers Sri Lanka (IELS), 2014). For instance, in America, ABET as the accreditation board, has specified that one of the criteria for accrediting engineering programmes is to communicate effectively in technical communication for engineering practice (ABET, 2019). Students are expected to equip themselves with effective communication skills before they graduate. As such, they are expected to gain the knowledge, skills, and behaviour of effective communication by the time they graduate (ABET, 2019). Furthermore, effective communication skills encounter the curriculum requirement that complements the technical content and is consistent with the programme's objectives (ABET, 2019). This scenario has also happened in other countries such as Singapore, United Kingdom, Hong Kong, Sri Lanka, and Malaysia.

Institution of Engineers Singapore (IES) has established the Engineering Accreditation Board (EAB) to certify that the engineering programmes act to train graduates with a comprehensive knowledge of essentials of the discipline and to cultivate in them an adequate level of professional competence that would meet the needs of the profession locally and be adequate for the responsible fulfilment of engineering assignments globally. The IES through the EAB is a full signatory of the Washington Accord starting the year 2006. The Washington Accord is an international agreement among bodies responsible for accrediting engineering degree programmes. It recognises the substantial equivalency of programmes accredited by those bodies. It also recommends that the other bodies recognise graduates of programmes accredited by any of the signatory bodies as having met the academic requirements for entry to the

practice of engineering at the professional level. The accreditation manual has mentioned that one of the students learning outcomes is on communication skills. So that, the students should be able to communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions (IES, 2018).

Engineering Council of United Kingdom has constructed UK Standard for Professional Engineering Competence (UK-SPEC) competence and commitment requirements for the purpose of engineering technician registration. One of the requirements is that engineering technicians should be competent. By being competent, they gained benefit from their education, training, experience, and effective communication and interpersonal skills, which includes the ability to use oral, written, and electronic methods for the communication in English of technical and other information; work efficiently with their colleagues, clients, suppliers, and the public which encounter the workplace environment (UK-SPEC, 2018). The Hong Kong Institution of Engineers (HKIE) is the professional engineering learned society and qualifying body for Hong Kong and has responsibility for setting and maintaining its members' professional and technical standards. An engineering higher diploma or equivalent programme accredited by the HKIE is an acceptable academic qualification for Associate Membership of the Institution. The HKIE's process of accrediting such programmes is called professional accreditation. In undertaking accreditation of engineering higher diploma and equivalent programmes, the HKIE seeks to meet the relevant international benchmarks. As the HKIE is a full signatory to the Sydney Accord, it shall ensure that the accreditation system, criteria, processes, and outcomes

meet all the requirements in the Agreement. According to the requirement in programme outcomes and based on generally accepted norms, engineering higher diploma and equivalent programmes must demonstrate that their graduates have an ability to communicate effectively to engineers and others regarding broadly defined engineering technology activities. Communication is one of the elements that should be included in the curriculum. It is essential for graduates of engineering higher diploma and equivalent programmes to have good communication skills. Engineering higher diploma and equivalent programmes should contain instruction in the art and practice of communication by the spoken and written word. It is important that graduates of engineering higher diploma and equivalent programmes have an appropriate English proficiency level (HKIE, 2015).

The Institution of Engineers, Sri Lanka (IESL) evaluates undergraduate engineering degree programmes and accords accreditation following established criteria and procedures through its Accreditation Board. The purpose of accreditation is to ensure that the engineering education programme concerned imparts the minimum academic requirements needed for an individual to register with the Institution as a graduate engineer. The processes of accreditation place emphasis on the quality of the students, academic staff, support staff and teaching facilities. It is about the continual improvement of engineering programmes.

Accreditation thus provides public knowledge of engineering education programmes that guarantee successful entry into the profession and gives prospective students an assurance of entry into the profession. It gives the government and the university feedback about the basic requirements of a graduate engineering education

programme, and the level of resources reasonably needed to meet these requirements. One of the generic attributes of an engineering graduate stated in the manual of accreditation of engineering programmes in Sri Lanka is communication. Graduates should communicate effectively on complex engineering activities with the engineering community and society at large, such as comprehending and writing effective reports and design documentation, making effective presentations, and giving and receiving clear instructions (IESL, 2014).

In Malaysia, the Board of Engineers Malaysia (BEM) is an organisation responsible for certifying registered engineers, engineering technologists and engineering technicians/inspectors who have achieved minimum requirements at par with global standard quality. BEM has appointed Engineering Technology Accreditation Council (ETAC, 2020) as a body to create detailed standard outline for accrediting engineering technology degrees and engineering technician education programmes in Malaysia. Apart from that, ETAC also has the responsibility to facilitate Higher Learning Institution when proposing a new programme to meet the minimum requirement to get accreditation. The standard outline also stipulated those students are expected to effectively communicate on distinct engineering activities within the engineering community and society. The students are expected to comprehend work related by others as well as document their work and give and receive instruction clearly (ETAC, 2020). Furthermore, one of the qualifying requirements for accreditation of a programme is a balanced curriculum that comprises all technical and non-technical features itemised in the programme outcomes. The curriculum is also expecting to have a balance between vital elements developing the core of the programmes. This includes optional studies (electives) or additional specialists, whereby cater not only the

engineering education but also general education courses such as soft skill courses or communication courses.

A vast literature mentioned above has shown that the ability to communicate effectively (both in spoken and written) is one of the most significant elements required in getting accreditation for engineering programmes from different countries globally. Not to mention it is also among the employability skills demanded by employers. For instance, as by Yusof et al. (2018) stated, a career in the civil engineering field depends profoundly on effective communication skills and became a key factor in success on a construction site project. In addition, employers repeatedly criticised that engineering graduates were proficient in technical skills but are deficient in practical communication (Lenard & Pintarić, 2018). According to Abdullah (2016), students in technical education should prepare themselves with 21st-century career skills in technical skills and non-technical skills such as skills in workplace communication. Furthermore, Carter et al. (2016) has pointed out that workplace communication skill is among the most needed skills by industries. Therefore, engineering students are expecting to master non-technical skills apart from technical skills before they graduate. This is because possessing effective communication may increase graduate's employability rate (Lenard & Pintarić, 2018; Pandiyan, 2017; Mohd Yusof, Ramlee, Syed A. Malik & Seri Bunian, 2014; Thanky, 2014; Washington, 2014; Ahmad & Yahya, 2011; Riemer, 2007). Furthermore, the highest frequently cited source of dissatisfaction within organisations and institutions is poor communication skills, especially among engineering students (Ramsey, 2016; Piyatida Changpeung & Fasawang Pattanapichet, 2015; Thanky, 2014). Consequently, engineering students were demanded to equip themselves with effective communication skills before they

completed the study and before seeking employment (BEM, 2019; IES, 2018; HKIE, 2015; IELS, 2014, Thanky, 2014; Azami et al., 2009; Hassan et al., 2006). This is aligned with the Strategic Planning of Polytechnic and Community College Malaysia, which stated that possessing effective technical communication skills will contribute to technical education institutions producing industry-fit graduates. This is because it is one of the outcomes of the first of six thrusts in redesigning Technical and Vocational Education Training (TVET) institutions by the TVET 4.0 framework (Strategic Planning of Polytechnic & Community College Malaysia, 2018-2025).

More specifically, a study by Masadliahani and Normah (2020) on workplace communication skills stated that written communication in English is important. They found out that writing reports, including general reports and progress reports, writing an e-mail, and letters should be written in the English language as lingua franca. Similarly, Yusuf et al. (2018) also claimed that English writing skills were an essential factor in today's worldwide workplace, especially in writing e-mails, memos, notices, meeting's minutes, technical reports, problem reports, daily reports and contract documents. Furthermore, activities related to workplace writing are writing minutes of a meeting, preparing project documents, and completing the report in English (Saleh & Murtaza, 2018). This is in line with the findings of a study by Chan (2019), which indicated that even in the non-native countries, everyday written communication events in the workplace such as report writing, minutes of meetings and e-mail should be performed in English used globally. Therefore, engineering graduates who could converse English fluently could confidently develop their careers and compete among engineering personnel (Masadliahani & Normah, 2020; Chan, 2019; Saleh & Murtaza, 2018; Zahari et al., 2016).

Technical communication through English Technical writing

According to Riordan (2005), technical communication is related to technical writing because it conveys technical communication by writing that intends to accomplish any work/task given. Inline, Manivannan (2005) states that technical writing that deals with special knowledge of science and technical subjects. More specific, technical communication is a standard word for all written and oral communication done at the workplace, particularly recognised with documents in technology, engineering, science and other fields with specialised vocabularies (Pfeiffer & Adkins, 2010). However, English Technical writing is a standard form of using the English language in a correct sentence structure, capitalisation, punctuation, vocabulary, spelling, and grammar. It is aimed to enhance students' ability to produce quality technical written documents in English (Latisha, Mohammad Fadhili, Mahani & Nazira, 2017; Corneal, 2015; Hairuzila, Azelin & Mohamed Noor Rosli, 2012). Good English Technical writing skills could assist the students in communicating effectively. Those students who can master good English technical writing would likely succeed in their future career path (Piyatida Changpeung & Fasawang Pattanapichet, 2015; Brown, 2008). This is because technical personnel such as engineers and technicians are expected to convey information using the English language through technical documents such as technical reports, manuals, memos, and instructions as standard modes of communication (Corneal, 2015; Hairuzila, Rohani, Azelin & Hezlina, 2010). A worker must write effectively to meet workplace expectations (Lenard & Pintarić, 2018; Rhoulac & Crenchaw, 2006). Therefore, mastering the English technical writing skill would be a bonus to those students.

Despite the expectation of using English at the workplace, previous researchers have initiated that English technical writing is the most challenging part of working life for an engineer or a technical staff (Piyatida Changpeung & Fasawang Pattanapichet, 2015; Van Emdan, 2005). Furthermore, writing is found to be the most difficult and important skill among the four components of English communication skills (Latief & Suharyadi, 2018; Qqab Jabali, 2018; Bulut, 2017; David, Thang & Azman, 2015; Fatima & Harison, 2015; Niswatin, Latief, & Suharyadi, 2018; Pham, 2015; Sultana, 2014; Suyanto, 2010; Nunan, 2001). Moreover, the difficulties in English technical writing had happened to students in the engineering field during their studies at a higher-level institution (Niswatin et al., 2018; Ramsey, 2016). Inline, Corneal (2015) and Sultana (2014) mentioned that the lack of knowledge, training, and motivation in English writing skills before entering a tertiary level of education might be the cause of why students are weak in writing. However, writing skills are important as they are used extensively in higher education and at the workplace (Siti Fazlina, Ramlee & Wan Mazlini, 2018; Tahriri, Shabani & Zokaei, 2016; Rushidi, 2012). Thus, English technical writing at the workplace is needed in the engineering profession, and effective communication is an essential component in the success of everyone and in any organisation (Sallehuddin, Mohd Amri & Mohd Taufiq, 2017). This is relevant to engineering education which involves numerous courses that require English technical writing competencies such as laboratory analyses, academic writings, project reports, and other written tasks and assignments. Hence, this parallels Tebeaux's (1983) statement to teach English Technical writing in an educational institution to prepare students for the kinds of writing they will be required to do on the job. In other words, an English technical writing course teaches students to apply their basic knowledge of writing to compose technical documents such as reports, manuals, instructions, memos,

resumes and so forth. For instance, writing a report after completing of a project or giving instructions on how to use specific machinery are the kinds of English technical writing that students are expected to produce at most tertiary technical institutions (Corneal, 2015; Hairuzila et al., 2012). Therefore, this shows the need for English technical writing skills for engineering students.

Hairuzila et al. (2012) studied the effectiveness of engineering students to learn English technical writing at a local private technical university. The results found that students could be motivated to learn English technical writing if the relevance of the course is clearly explained to them and if they are shown how, it would be helpful to them in the workplace. Besides, preparing the engineering students with English Technical reports writing has become the major focus of technical writing since it is part of an engineer's job (Corneal, 2015; Silyn-Roberts, 1998). Thus, the ability in English Technical writing effectively is advantageous to engineering students so that they would not have any difficulties in coping with accomplishing their written tasks to meet certain deadlines as future technical personnel such as technicians and engineers. Thus, this shows that English Technical writing competence is highly important in any organisation. English Technical writing is not applied for science, technology, and engineering subjects only; all professional fields require competence in English technical writing (DuPius, 2018; Walsh, 2010; Reep, 2003). In fact, according to DuPius (2018), the demand for English technical writing skills is expected to increase by 10% for each year starting 2014 to 2024.

English communicative competence in engineering field

A person should master the language used as a medium of instruction to convey information efficiently. In this study, the English language has been used as the medium of instruction since it is an important medium of communication. Previous researchers had identified that the most important medium to communicate across borders globally is through the English language (Evangeline & Ganesh, 2016; Joshi, 2013; Thanky, 2014; Seetha, 2012; Yadollahi, Asli & Gul, 2012). Therefore, competence to communicate in English, both written and oral, is a credit to success.

According to Bonk, Imhoff and Cheng (2002), both written and oral communication skills in English are the keys to success within the engineering profession. Moreover, most employers look for candidates who have not only excellent academic performance but also possess good communication skills in both oral and written English (Sallehuddin, Mohd Amri & Mohd Taufiq, 2017; Rosdiadee, 2013; Ezihaslinda, Noor Raha, Wan Jumani & Noor Azlinda, 2011; Raftopoulas, Coetzee & Visser, 2009; Raybould & Sheedy, 2005). Additionally, the job entry requirement for positions such as assistant service engineer, technical service representative, draughtsman, project engineer, maintenance engineer, and technician demanded applicants who have a good command of both verbal and written communication skills in English besides academic qualifications (*JobStreet*, n.d.). Furthermore, skill in communicative English, especially English Technical writing skills, is the most needed skill if the prospective candidate intends to step into the engineering profession at a multinational company (Evangeline & Ganesh, 2016).

A study conducted by Siti Hamin and Ismie Roha (2005) on writing proficiency among engineering students found that the respondents were weak in English technical writing. In this case, graduates may be lacking in writing practices during their studies. It could be due to the English programme that students went through was inadequate in preparing them for English technical writing at the workplace tasks. Nevertheless, a study by Hafizoah and Fatimah (2010) has found that writing in English to be of equal importance to speaking and was rated the most important skill by a group of engineers from 10 multinational companies across Malaysia. Also, market research on the industrial needs of English language competency for entry-level employment was conducted by Ainol, Isarji, Mohamad Sahari, and Tunku Badariah (2011) reported that writing skills in English are very much as important as speaking and listening skills in English.

An empirical study conducted by Indra Devi, Noraini and Subatira (2010) found that in English Technical writing, such as writing technical reports and oral presentations, engineering students most often fail to demonstrate a command of expected vocabulary, error-free sentence structures and requisite grammar to communicate the material content accurately. The possibilities of failure, poor performance, afraid of evaluation, negative attitudes towards writing activity or assignment may create negative feelings towards writing, so-called writing apprehension. A study on engineering students' perception towards writing in English by Hairuzila (2008) found that students' perceptions towards writing could be divided into three categories: (1) students who like and have the confidence to write, (2) students who are a bit reluctant to write due to lack of confidence; and (3) students who hate writing because they feel that the task is difficult due to the lack of proficiency in

English mostly in grammar and vocabulary. Hence, lacking awareness of the importance of technical writing exists among engineering students at technical institutions in Malaysia. On the other hand, every educational institution's objective is to produce high-quality graduates who can contribute effectively to the organisation that they are working for (Hairuzila, 2008). Furthermore, employers had complained that engineering students are weak in writing items such as technical reports and laboratory reports in terms of content, structure, and language (Sallehuddin et al., 2017). Thus, this shows that effective English technical writing skills are needed in the workplace.

Attention has been given to students' writing abilities in the sciences and engineering at a tertiary level of education. For instance, the Accreditation Board in Engineering and Technology (ABET) in America requires engineering programmes to assess students' writing more holistically through the programme's outcomes and assessment criteria that students must attain throughout their undergraduate education (ABET, 2019; Rhoulac & Crenshaw, 2006). Similarly, in Malaysia, Engineering Technology Accreditation Council (ETAC, 2020) is a body made up to represent the Board of Engineers Malaysia (BEM, 2019) for accreditation purposes of engineering technicians and degrees in engineering technology qualifications. The main objective of accreditation is to ensure that the accredited engineering programmes carried out by the institutes of higher learning in Malaysia have satisfied the minimum academic requirements for their graduates to be registered with the BEM. Graduates obtaining Engineering Diplomas and Engineering Technology Diplomas are often employed as engineering technicians in many fields, including technical operations, product design, field engineering, quality control, system engineering and many others. As stated in

the ETAC (2020) manual, students of an engineering technician diploma programme are assumed to achieve effective communication by graduation, as it is one of the programme outcomes.

Issues on English Language content, course, and curriculum at Malaysian Polytechnic Education

Starting in 1999, polytechnics in Malaysia had offered English for Technical Purposes (EFTP) for students who undertook engineering programmes (Ministry of Higher Education, 2003). Inconsequence, as time goes by; many debates arose on poor English language proficiency of polytechnic students (Rashidah & Salmiza, 2018; Kho & Leong, 2015; Suhaily & Faizah, 2013a, 2013b; Khairuddin, 2011; Ahmad Yasruddin et al., 2010). A study by Ahmad Yaruddin et al. (2010) found that the level of English language proficiency of graduates from polytechnic engineering students was not achieving the standard requirement at the workplace including skill attributes which cater a combination of academic tasks and specific jo-related tasks such as sentence structure, language function, correct grammar, appropriate vocabulary and writing reports. The findings derived Ahmad Yasruddin et al. (2010) to recommend in reviewing the curriculum of English language courses offered at Malaysian Polytechnic.

Accordingly, changes were made by the Curriculum Development Centre of the Department of Polytechnic Education (DPE) after efforts were undertaken with the academicians in universities and employers in the industry (DPE 2010; 2011, 2014). At

the beginning of 2010, all students who undertaken diploma programme at a polytechnic in Malaysia must sign up for taking the Communicative English courses as a switch to English for Technical Purposes (DPE, 2010). However, the current Communicative English teaching policy at polytechnics does not emphasise the initial aims of offering English language courses at polytechnic to prepare students with required skills in academics and technical contexts before the students leave for working in industries (Rashidah & Mohamed Amin, 2018; Lam & Chong, 2013). In addition, a recommendation from industry on polytechnics students who have experience in industrial training reported that the students need to improve their English technical writing skills, including writing the technical report. Incompetence in English technical writing among polytechnic interns might affect the productivity of related industries and reduce the chances in spreading the company's prospect in the global arena (Maizan, 2016; Aruna, 2012; Politeknik Sultan Azlan Shah, 2013; *Jobstreet.com*, n.d). This is because problems may appear to the industry if technicians failed to convey effective communication such as failure in writing a comprehensive report to the engineer or manager, which might lead to productivity decrease of the industry. According to Rashidah and Mohamed Amin (2018), even after more than seven years of the execution of Communicative English (CE) in the polytechnics, the English proficiency level of polytechnics students is still not at the satisfactory level. Maizan (2016) had identified that polytechnic students are having difficulties in Communicative English even in introducing themselves. They were also found lacking in knowledge on pronunciation, spelling, phonology, comprehension and creating own sentences in English.

A study by Lam and Chong (2013) had investigated polytechnic students' perceptions of their language learning experiences during their Communicative English course and revealed that more than half of the students agreed that the English language curriculum did not help them to improve their English in a technical context. This indicated that polytechnic overlooked to provide relevant English course in the curriculum of the polytechnic engineering education system in Malaysia (Ahmad Yasruddin et al., 2010). In other research conducted by Sanmugam, Rajanthran and Nurul Wahida (2012) at a polytechnic in Malaysia found that some contents of the material used in the module of Communicative English course at polytechnic are unrelated to the needs of students in the engineering field. This also showed that there is mismatch of students' needs with the curriculum provided by the polytechnic. In addition, a study conducted by Ahmad Yasruddin et al. (2010) on English technical writing skill deficiencies of polytechnic students, found that understanding technical documents, using correct grammar, vocabulary and sentence structure, writing test/investigation report and questioning for clarification are among the important skills that polytechnic students lacked. However, these are the skills that students should acquire and demand by the industries (Ismail, Ahmad & Awang, 2017; Ahmad Yasruddin et al., 2010; *Jobstreet.com*, n.d.). However, knowledge and skills in English technical writing are included as parts of the important competency related to effective communication that engineering students should acquire (BEM, 2019). In consequence, if polytechnic failed to provide competent graduates in English technical writing, a possibility that industry would not be offering any job to the polytechnics graduates will increase, and the possibility of marketability rate of polytechnics graduates will decrease.

Modular instructional materials

Advantages of using module in teaching and learning are remarkable. Authentic learning material such modular instructional materials could help effective communication in the classroom (Yugandhar, 2014). Modular learning as one of the instructional materials has been used widely even literature has indicated materials as modules should be developed for learners (Kitao & Kitao, 1997). In line, it is identified that the use of modules could be a substitute instrument for learning and moreover for learners' satisfaction (Nardo & Hufana, 2014). Accordingly, Ahmad, Ali, Nordin and Nabil (2017) stated that teaching and learning sessions which used modular instructional materials have showed second highest score as preferred learning method. According to Moradi et al. (2018) using modules provides positive acceptance from the students whereby it helps students to be able to apply self-control over their speed while learning. Students noted their increment in level of satisfaction and level of engagement in the undertaken course after using module and derived self-directed learning when using the module (Kuo et al., 2016; Sahin & Shelly, 2008). In other study by Neo and Neo (2009) revealed that students expressed high rate and positive attitude towards the used of module and they favoured integrating using module into their classrooms. Thus, the students need to be provided with the necessary and suitable learning materials (Waguey, 2012). Consequently, by providing the necessary materials like using suitable modules may enhance students' satisfaction and improvement in the learning and teaching session which should derive enhancement in knowledge and skills in any subjects that they are undertaking during their study.

A study by Sakhieva et al. (2015) on designing a structure of a modular competence-based curriculum and technologies for its implementation into higher vocational institutions has stated that the current curricula are: 1) incapable to execute the change of learning process which is based on competencies structure; 2) incapable to make certain that the students' training encounters the necessities of the labour market; 3) incapable to manage the development of individual learning ways in a flexible educational structure considering each student's needs, interest, and characteristics. Accordingly, they introduced a modular competence-based curricula which was based on modular competence-based approach by implementing a learning concept based on learning outcomes whereas anticipated performance of what a student should know, understand and be able to do at the end of certain learning sessions.

As mentioned earlier, research conducted by Sanmugam, Rajanthran and Nurul Wahida (2012) at a polytechnic in Malaysia found that some contents of the material used in the module of Communicative English course at polytechnic are unrelated to the needs of students in the engineering field. In different angle, apart from mismatching between what students' needs with what polytechnic has provided, this issue also showed that there is a lack of effective instructional materials used in the polytechnic education system. For instance, an empirical study at other polytechnic settings in Malaysia had identified that the existing module provides a very limited information on how to conduct a mini-project which includes doing research (Siti Fazlina et al., 2018; Siti Fazlina, Ahmad Faiz, Fauziah & Ramlee, 2019). Accordingly, a need analysis was conducted at a different polytechnic and had found out the perceived knowledge and skills related to English technical writing domains as needed

by the polytechnic engineering students and their lecturers (Siti Fazlina, Ramlee & Wan Mazlini, 2017).

1.2 Statement of the Problem

Lacking English language proficiency in communication skills both oral and written among polytechnic graduates' students has been one of the factors that contributed them failed to get employment. On the other hand, industries have recognised that effective English communication skills both in oral and written form is one of the employability attributes that students must grasp before graduated. Moreover, it is beneficial to possess such skills especially for engineering future graduates despite owning technical skills.

As mentioned earlier, the importance of effective communication specifically English communication skills is undeniable since it is a globally need to be possessed by future engineering graduates. This is because most of the sectors in engineering industries including the bodies of accreditation for engineering programmes at all most all over the globe have consensus in recognising effective communication as one of the attributes in the requirement list as a general accreditation criterion in getting accreditation for the engineering programmes offered at institutions. More specifically, as discussed earlier, previous literature also stated that engineering industry has recommended that polytechnic engineering students need to improve their English technical writing skills which comprises writing technical report in terms of sentence structure, technical terminologies, appropriate vocabulary, and mechanics of writing.

Unfortunately, the current English course syllabi offered in the curriculum for engineering programmes at Malaysian polytechnics namely Communicative English courses for diploma programmes has not emphasised technical writing skills. Furthermore, some contents of the material used in the module of Communicative English courses at polytechnic are unrelated to meet the needs of the engineering students. Consequently, polytechnics students do not have the knowledge in English technical writing that they supposed to possess. This showed the mismatch between the needs of students with the curricula provided in the engineering programme at Malaysian polytechnics. As A Result, the students did not get sufficient practice in writing which led to the lack of English technical writing competence in terms of knowledge and skills. Thus, it is not impossible why graduates from polytechnic neglected to perform well in job interview that headed to secure job application even though they possess good technical skills. This showed how important effective English communication skills at the workplace play its role. In addition, written communication is a vital matter at the workplace since miscommunication might give a big negative impact to a company. Besides, in engineering sectors, most of the job-related tasks are written in English. Therefore, English technical writing skills is crucial to possess since the benefits are unquestionable for future graduates' engineering students.

From the above-mentioned statement, this study tries to fill the gap of mismatch of what polytechnics has provided their graduate students with what the students' need and the industries' need from the graduate students. Thus, to fill the gap, this study has developed a new module on English technical writing knowledge and skills through learning a mini-research project topic. The module used included important technical writing domains with inclusive authentic examples of sentences in English technical

writing style and enriched with English technical writing practices. Apart from that, this study aims to identify the effect of the new module, namely the Mini-Research Project (MRP), on polytechnic engineering students' English technical writing competence in terms of knowledge, skills, and attitude. The contents of the new module provide basic knowledge and skills (as theory and practical) in the process of writing a mini-research report (as a technical report) and how to carry out a mini-research project. Furthermore, this study also has filled the gap in the literature of English technical writing competency by using a quasi-experimental research design method to identify the effect of a Mini-Research Project (MRP) module on polytechnic engineering students' technical writing competency.

1.3 Purpose and Objectives of the Study

The main purpose of this study was to develop a new module namely the Mini-Research Project (MRP) Module and to determine the effects of it on polytechnics engineering students in Malaysia regarding their English technical writing competence by applying a quasi-experimental research design (pre/post-test). The aspects of English technical writing competence are on knowledge, skills, and attitude. Therefore, in specific, the objectives of the study are as follow:

1. To design and develop MRP Module based on English technical writing competency for engineering polytechnic students in Malaysia.
2. To examine the effect of using MRP Module

3. To examine if there is any significant difference between pre-test and post-test mean scores on students' English technical writing competence in terms of knowledge and skill in experimental and control groups.
4. To identify if there is any significant difference in post-test mean scores on students' English technical writing competence in terms of knowledge and skills in technical writing between male and female students in experimental groups.
5. To identify if there is any significant difference in post-test mean scores on students' English technical writing competence in terms of knowledge and skills between low, medium, and high socio-economic status of students in experimental groups.
6. To identify if there is any significant difference in post-test mean scores on students' technical writing competence in terms of technical writing competence in terms of knowledge and skill between students with low, medium, and high previous English language proficiency levels in experimental groups.
7. To identify students' perceptions on the effects of using the MRP Module on their English technical writing competence in terms of attitudes.

1.4 Research Questions

The following are the research questions constructed based on the research objectives stated earlier:

1. What is the design for developing MRP Module based on English technical writing competency for engineering polytechnic students in Malaysia?

2. Is there any significant difference between pre-test and post-test mean scores on students' knowledge in English technical writing in the experimental group and in the control group?
3. Is there any significant difference between pre-test and post-test mean scores on students' skills in English technical writing in the experimental group and in the control group?
4. Is there any significant difference in post-test mean scores on students' knowledge and skills in English technical writing between male and female students in experimental groups and in control groups?
5. Is there any significant difference in post-test mean scores on students' knowledge and skills in English technical writing between low, medium and high socio-economic status for students in experimental groups?
6. Is there any significant difference in post-test mean scores on students' knowledge and skills in English technical writing between students with low, medium, and high previous English language proficiency level in experimental groups?
7. What are the students' perceptions on the effects of using MRP Module on their attitudes toward English technical writing competence?

1.5 Null Hypotheses

The following are the null hypotheses of this study:

Ho1: There is no significant difference between pre-test and post-test mean scores on students' knowledge in English technical writing in the experimental group.

Ho2: There is no significant difference between pre-test and post-test mean scores on students' knowledge in English technical writing in the control group.

Ho3: There is no significant difference in post-test mean scores on students' knowledge in English technical writing between the experimental groups and the control groups after controlling the effect of pre-test.

Ho4: There is no significant difference between pre-test and post-test mean scores on students' skills in English technical writing in the experimental group.

Ho5: There is no significant difference between pre-test and post-test mean scores on students' skills in English technical writing in the control group.

Ho6: There is no significant difference in post-test mean scores on students' skills in English technical writing between experimental groups and control groups after controlling the effect of pre-test.

Ho7: There is no significant difference in post-test mean scores on students' knowledge in English technical writing between male and female students in experimental groups.

Ho8: There is no significant difference in post-test mean scores on students' skills in English technical writing between male and female students in experimental groups.

Ho9: There are no significant differences in post-test mean scores on students' knowledge in English technical writing between students from low, medium, and high socio-economic status in experimental groups.

Ho10: There is no significant difference in post-test mean scores on students' skills in English technical writing between students from low, medium, and high socio-economic status in experimental groups.

Ho11: There is no significant difference in post-test mean scores on students' knowledge in English technical writing between students from the low, medium, and high level of previous English language proficiency in experimental groups.

Ho12: There is no significant difference in post-test mean scores on students' skills in English technical writing between students from the low, medium, and high level of previous English language proficiency in experimental groups.

1.6 Conceptual Framework

The conceptual framework describes the relationship among the variables of the study that shows the direction to achieve the outcome of the study (Smyth, 2004; Miles & Smith et al., 2003; Huberman, 1994). Other than that, it also consists of models and theories that underpin this study. The theoretical underpins the development of the module was adapted from the communicative competence theory and model (Schardamalia & Bereiter, 1982; Canale & Swain, 1980; Hymes, 1967), the cognitive process of writing theory (Flower & Hayes, 1981). Besides, this study also adapted the competency model from Spencer and Spencer (1993), and from various models of technical writing domains in previous literature (Laplante, 2018, 2012; Pfeiffer, 2010;

Finkelstein, 2007; Pfeiffer, 2005; Van Emdan, 2005; Budinski, 2001; Montgomery & Plung, 1988; Markel, n.d.). These are explained further in Chapter 2.

Figure 1.1 illustrates the conceptual framework of this study which encompasses a few models and theories that underpinned the development of the Mini-Research Project (MRP) and finally derived to determine the effect of using the MRP Module on polytechnic engineering students' English technical writing competence. The conceptual study was started with module development phase which comprises a few stages of developing the MRP Module as the main research tool. The MRP Module was developed and based on the ADDIE Model of instructional system design: (1) analysis, (2) design; (3) development, (4) implement; and (5) evaluate. In the phase of module development, several models of module development procedures by previous literature were also referred to (Mohammad Aziz Shah, 2012; Sidek & Jamaluddin, 2005; Russel, 1974). Further explanation of the module development is explained in Chapter 4 of this study. The second phase in the conceptual framework of this study is the experimental phase whereby the purpose is to examine the effect of the MRP module by applying quasi-experimental research design. As stated by previous researchers that experimental research design is intended to examine the relationships between the cause and effect in using an intervention (Ghazali & Sufean, 2018; Creswell, 2014; Smith, et al., 2003; Campbell & Stanley, 1963). In the context of this study, the intervention used is the MRP Module as the independent variable. The conceptual framework also explains the relationship of the cause and effect between an independent variable (MPR Module) and a dependent variable (level of English technical writing competence of engineering polytechnic students). This study also employed the concept of using a module (cause) to achieve certain objectives as the

outcome (effect) of the study (Ghazali & Sufean, 2018; Mohammad Aziz Shah, 2012; Shamsuri, 2012; Wijayanti, 2012; Behlol, 2009; Sidek & Jamaludin, 2005; Miller, 1979; Elam, 1986; Russel, 1974). The dependant variables which act as the intended effects are the improvement of students' English technical writing competence. According to Spencer and Spencer (1993), competence is defined as "an underlying characteristic of an individual that is causally related to criterion-referenced effective and/or superior performance in a job or situation" (p. 9). Thus, competence is described as the knowledge, skills, self- concept, values, traits, and motives of an individual (Spencer & Spencer, 1993). However, to suit the aim of this study, the researcher is only focused on three elements of competency, which are knowledge, skills, and attitudes towards the English technical writing of engineering polytechnic students. As stated by Petric (2002), students who received more knowledge and practices may gain competency in the tasks given to them, which will lead to better knowledge, skills, and attitudes. However, there are a plethora of studies which focused on factors that influenced students' writing competency such as gender, writing anxiety and attitudes toward writing (Ali, 2017; Bulut, 2017; Cocuk, Yelken & Ozer, 2016; Liu & Ni, 2015; Bayat, 2014; Tezkan, 2012; Hairuzila, 2008; McClenny, 2010; Nausheen & Richardson, 2010; Daly & Miller, 1975).

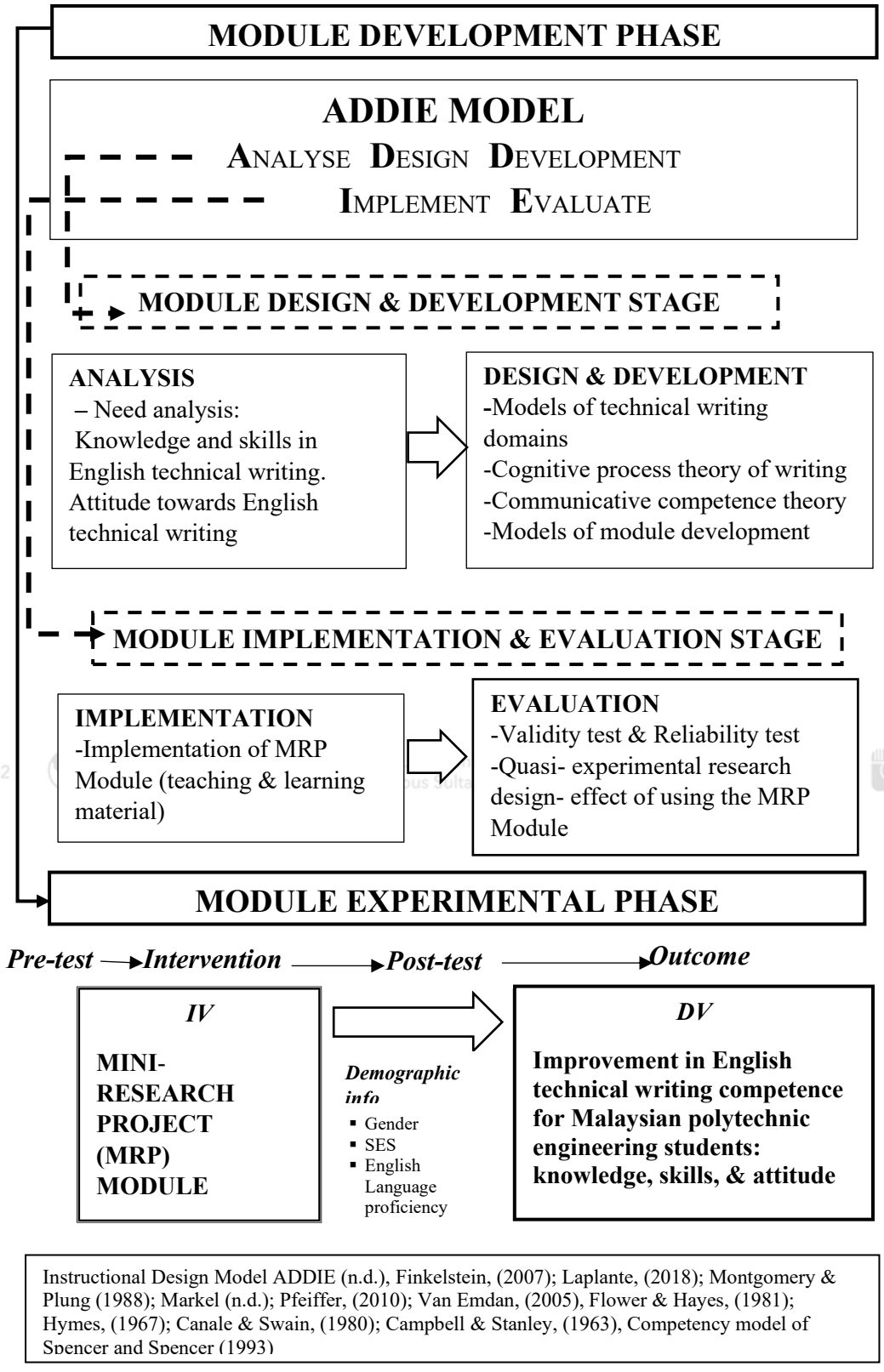

Figure 1.1. Conceptual Framework of the Study

1.7 Operational Definition

The present study has identified several terms that are important to define in the context of the research.

1.7.1 Mini-Research Project (MRP) Module

A module is an independent learning package offered to aid students in achieving certain instructional objectives (Giddings, 1986). A module is also defined as a teaching package related to a unified concept of a lesson (Russel, 1974). According to Elam (1971), as cited in Giddings (1986), a module is a set of learning activities intended to facilitate the students' acquisition and demonstration of a particular competency. Husen et al. (1994) define a module as a complete unit of curricular material in which additional units may be added to achieve certain objectives. While Kulkarni (1986) refers to a module as a mode of working with some instructional material. On the other hand, Sakhieva et al. (2015) focused on a specific modular function which is based on competence in curricular education. The modular competence-based curriculum they define are targeted at obtaining specific competencies needed for earning a particular grade within a certain qualification to successfully achieve professional activities and stimulate social and personal improvement of the students (Sakhieva et al., 2015). More specifically, Moradi et al. (2018) referred a module as an intervention which structured with several key educational principles such as prior knowledge, integrating testing and individual self-paced learning. Consequently, in the context of this study, a module is referred to an activity module consisting of a set of instructional materials and practices to a sub-topic

of a Communicative English course three which are related in carrying out a mini-project with basic research approach namely as Mini-Research Project (MRP) Module. The MRP module aims to build up polytechnic engineering students' English technical writing competence in terms of knowledge, skills, and attitude towards English technical writing. Besides, the content of the MRP module is adapted from models of technical writing domains, cognitive process writing theory, communicative competence theory, and behavioural learning theory. The contents in the MRP Module are based on English technical writing competence which emphasised on knowledge and practices in correct usage of grammar, sentence structure, specific terminology, mechanic of writing, standard format of writing a mini research report, and presentation skills. Intentionally, beyond using the MRP Module, the students are hope to capable to develop positive attitudes toward English particularly in technical writing such as writing a mini research project report.

1.7.2 Technical Writing

The concept of technical writing in this study is adapted from several models of technical writing which consists of eight main domains (Laplante, 2018, 2012; Pfeiffer & Adkins, 2010; Finkelstein, 2007; Van Emdan, 2005; Reep, 2002; Budinski, 2001; Montgomery & Plung, 1988). The eight domains of technical writing selected for this study are the domains that are related to writing a project report which involves doing research: (1) concept of technical writing, (2) nature of technical writing, (3) sentence structure; grammar, and writing mechanics, (4) principles and styles in technical writing, (5) planning to write; (6) technical reporting, (7) presentation and graphic communication

and (8) ethical consideration. Besides, technical writing refers to a process that is designed to deal and convey technical information or subject through writing which helps to communicate complex information clearly and precisely to a specific audience and specific purpose (Indra Devi, Noraini Husin & Subatira, 2010; Finkelstein, 2005). Instead, technical writing is a form of communication as a generic term for all written and oral communication done on the job (Pfeiffer & Adkins, 2010; Reep, 2002). However, in the context of this study, technical writing is described as writing to convey information related to the engineering field, which involves doing research using technical writing principles and styles.

1.7.3 Communicative Competence

Communicative competence is the ability to practise a language or interpret language correctly in the process of communication with social practices (Hymes, 1972). Likewise, in the context of communication culturally, communicative competence to Canale and Swain (1980) and Celce-Murcia (2007) is one's capability of using language correctly, acting with proper behaviour accordingly with appropriate situations. Thus, communicative competence in this study is referred to as the ability to use the English language correctly and appropriately to relay engineering related information through a mini-research project activity of Communicative English course written task such as writing practices for writing a meaningful mini-research project report. Thus, through doing the writing practices in the English language given in the MRP module, students' attitudes towards English could be improved.

1.7.4 English Technical Writing Competence (Knowledge, Skills & Attitude)

Competence is defined as a person's underlying characteristics related to the effectiveness and individual performance on the job (Ozcelik, 2006; in Irawan, 2011; Lavenson, 2006). While Quinn, Faerman, Thompsom, and McGrath cited in Su-Chin, Ju-Shin and Hung-Chun (2012) pointed out, competencies were related to knowledge and skills for completing certain projects or tasks successfully. Spence and Spencer (1993), defined competence as "an underlying characteristic of an individual that is causally related to criterion-referenced effective and/or superior performance in a job or situation" (p. 9). Vazirani (2010), listed Spencer and Spencer's definition of competence with five elements which are knowledge, skills, self- concepts and values, traits and motives. Therefore, technical writing competence in this study is adapted from the above definitions with three elements, i.e.: knowledge and skills of writing a mini-research project report (e.g., the process of writing, format, and content of the report), knowledge and skills in English technical writing (e.g., sentence structure, grammar, vocabulary and writing mechanics), and attitudes towards English technical writing. According to Graham et al. (2007), writing attitude is described as the effect of writing activities that changes the author's character from feeling happy to disappoint. While Petric (2002), points out that if students are given chances of more knowledge and practices, their attitudes towards writing might change since writing experiences can form students' attitudes and influence students' future writing behaviour. Besides, writing attitude is one of the most effective factors of writing achievement besides other factors such as self-efficacy belief, interest, and motivation (Bulut, 2017). For that reason, in the context of this study, attitude towards writing is described as the positive change of attitudes of

engineering students towards English technical writing competence after using the MRP module.

1.7.5 Polytechnic Students

Mostly, polytechnic students are school leavers who possess SPM (Certificate of Malaysian Examination) who pursue technic and vocational programmes at diploma level in polytechnics in Malaysia. The standard duration of diploma programmes takes six semesters to be completed. This present study situates its context within two conventional polytechnics which were selected randomly from 18 conventional polytechnics (official figure during the present study is embarked) situated at Peninsular Malaysia (DPE, 2017). Polytechnic students in this study are referred to semester four engineering students who enrolled in any Diploma of Engineering programmes. The students learn how to carry out a mini project which involves doing research. It is a sub-topic of the Communicative English 3 Course offered at polytechnics in Malaysia.

1.8 Scope of the Study

This study covered two conventional Malaysian polytechnics located in Peninsular Malaysia that offer programmes in engineering. It also covered semester four engineering students from the two polytechnics which were selected using multistage random sampling. Apart from that, this study also covered the semester four engineering students from the two polytechnics using mainly quantitative approach. This study explored the

development of a new teaching and learning module using ADDIE model and examine the effects of using the module by employing quasi experimental research design. The new module developed in this study covered a sub-topic of a mini project from the Communicative English Course. The effects of using the module were covered only on the polytechnic engineering students' communicative competence of knowledge, skills, and attitudes toward English technical writing.

1.9 Limitations of the Study

This study has several limitations. First, this study is limited by the location of the data collection. The researcher has embarked on the study at two conventional polytechnics located in Peninsular Malaysia only. This is because the study focuses on examining the effects of MRP module on polytechnics students' technical writing competence and not highlighting to generalise the findings. Thus, this study has adapted a four-group quasi-experimental research design since it is believed to be convincing and have strong internal validity of the effects of the experimental design (Nubli, Maziah & Mohd Firdaus, 2012; Shamsuri, 2012; Sekaran, 2003; Braver & Braver, 1988; Brock, 1978; Campbel & Stanley, 1963). Therefore, the present study has applied between-groups designs of experimental quantitative research method. However, the data were gathered from four intact groups of two different polytechnics locations, which were selected using multistage random sampling. Furthermore, the researcher was not allowed to assign random sampling to the participants to form artificial groups of experimental groups and control groups. This is to avoid disturbing other classrooms learning (this is further explained in Chapter Three).

The second limitation of this study is about the content of the MRP module. The contents of the MRP module focused on this study are based on a mini-research project topic of Communicative English 3 course syllabus designed for diploma in engineering programmes at Malaysian polytechnics. As mentioned earlier, the Communicative English 3 course at polytechnics is taught to provide students with skills needed at the workplace, such as writing an effective project report (Ministry of Higher Education, 2003). This is in line with BEM's demands whereby effective communication is emphasised (BEM, 2019). Therefore, the content of the module is mostly based on how to carry out a research-based mini project (research skills such as conducting survey, reporting, and presenting findings of the mini-research project), which applies the technical writing domains. Thus, this study does not cover other genres of technical writing in the Communicative English 3 course syllabus of Malaysian polytechnic such as writing instructions, process and procedures, memo, resume, job application letter and so forth.

Thirdly, this study is also limited by the elements of technical writing which were adapted from previous literature mainly from the models of technical writing domains of Laplante (2012, 2018) and other several models (Budinski, 2001; Finkelstein, 2007; Gerson, (n.d.); Markel (n.d.); Pfeiffer & Adkins, 2010; Reep, 2002; Van Emdan, 2005). Thus, the selected technical writing domains adapted are: (1) Concept of technical writing, (2) Nature of technical writing, (3) Sentence structure, grammar & mechanics of writing, (4) Principles & styles in technical writing, (5) Planning to write a technical document, (6) Technical reporting, (7) Presentation & graphic communication, (8) Ethical consideration. The technical writing domains were selected because most of them have appeared in the literature of technical writing. Besides, they fit the objectives of this

study. Therefore, the students' technical writing competence examined in this study did not cover other technical writing elements from other sources as mentioned above.

Fourthly, this study is limited by the activities and practices which are based on the component of linguistic competence or grammatical competence of Communicative Competence theory (Poolswad et al., 2015; Ying, 2007; Canale & Swain, 1980). This is because they are relevant to the purpose and objectives of this study. Thus, the study focuses on correct sentence structure, grammar, and mechanics of writing. Therefore, other aspects of English language acquisition are not included in this study.

Based on the competency concept of Spencer and Spencer (cited in Vazirani, 2010), competency is made of five elements which are knowledge, skills, self- concepts and values, traits, and motives. However, as previously mentioned, this study only focuses on three elements of competency, which are knowledge, skills, and attitude. Thus, this is the fifth limitation of the study, and other competencies elements are not discussed in this study.

1.10 Significance of the Study

The purpose of this study is to develop a module namely as Mini- Research Project (MRP) Module on English technical writing competence for engineering students at Malaysian polytechnics and to examine the effects of the MRP Module. In general, the results of the study provided positive impacts in different angles.

The findings of the study have shown improvements in technical writing competence in terms of knowledge, skills, and attitudes towards English technical writing among engineering polytechnic students. Particularly, the use of the module has helped the students in the process of learning how to carry out a research-based and writing a meaningful project report in using English technical writing. The results of the study have helped the students to reinforce their communicative competence, especially in writing in terms of the correct use of grammar, mechanical rules and at the same time, help to build vocabulary. Hence, the students were encouraged and be familiar with using proper vocabulary, spelling, punctuation, error-free sentence structure and grammar in English and to produce a standard report with better quality of report writing in their future. The effect of the study could be an added value to the students in producing a quality research report whereby the students were also introduced to ethical considerations while conducting and writing their mini-research project. Therefore, the findings of this study have given positive effects on students' attitudes toward English technical writing and be able to change the students' perceptions towards writing in English. Students could also use the MRP module as a reference in carrying out any research-based project. Furthermore, competence in written skills could enhance students' chances of securing job application in their future career since the competency of written communication in English has become one of the skills demanded by industries these days.

This study has contributed to the enrichment of material used in the teaching and learning of subjects which consist of the element in technical report writing. The use of the MRP module has given positive results, and the module could be used by English lecturers in teaching the topic of a mini project of Communicative English Course at other polytechnics.

This study employed a quantitative experimental research design which adapting the quasi-experimental research design to examine the effect of an intervention (MRP module) on students' technical writing competence. Therefore, this research method design is meant to establish a possible cause-and-effect relationship between the module and the technical writing competence. The method employed is believed to be a reality since it can be statistically analysed and less arguable about the results (Shuttleworth, 2008). Therefore, this would increase the internal validity of the effects of the intervention which is the MRP module (Shamsuri 2012; Sekaran, 2003; Braver & Braver, 1988; Brock, 1978; Campbel & Stanley, 1963). Since this study employed a quasi-experimental research design whereby the respondents were selected using multistage random sampling to get samples from the population and avoid or reduce bias probabilities. Thus, the findings could not be generalised to the population.

The implication of this study would be beneficial to the Department of Curriculum of Polytechnic and Community College Education in reviewing a new curriculum for their technical and vocational programmes to integrate technical writing course in the Diploma of Engineering programmes at polytechnics. This could enrich students' knowledge and skills in technical communication, especially in English technical writing. Furthermore, this could awaken the students of the importance and the relation of technical writing skills, especially in English in any written task of their core subjects. Thus, the findings of this study could help to increase the quality of polytechnic graduates and improve the marketability of graduates from polytechnic. Since polytechnic is one among the Malaysian sources in producing technical personnel, therefore; in such situations, investigating students' English technical writing competence is crucial in the context of Malaysian polytechnic. Hence this study is significant to

develop the MRP module and examine the effects of using it on students' technical writing competence.

Besides, this study has filled the literature gap in lacking to provide necessary content and instructional material considering technical writing competence to polytechnic engineering students in Malaysia. This could be achieved by proposing to embed technical report writing elements in the English language syllabi at the technical institutions Furthermore, this study also has filled the gap in the literature of English technical writing competency by using a quasi-experimental research design method to identify the effect of a Mini-Research Project (MRP) module on polytechnic engineering students' English technical writing competency.

1.11 Summary of the Chapter

This chapter has overviewed the present study by providing brief contextual information through the problem statement, the purpose and the research objectives, the research questions, the research hypotheses, and the conceptual research framework. It also embraces the operational definition of terms used in this study, the limitations, and the significance of the study. The following chapter/ Chapter Two discusses selected theories and models relevant to the present study. Apart from that, the chapter also provides a review of the past studies conducted in related areas.