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**AN ANALYSIS OF STAFF PERCEPTIONS OF THEIR  
PREPAREDNESS FOR THE IMPLEMENTATION  
OF ACTIVE LEARNING IN  
MALAYSIAN ENGINEERING EDUCATION:  
EXPLORATORY APPROACH**

**NORHARIATI ISMAIL**  
Doctor of Philosophy

ASTON UNIVERSITY  
February 2018

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**ASTON UNIVERSITY**

**An Analysis of Staff Perceptions of Their Preparedness for the Implementation of Active Learning in Malaysian Engineering Education: Exploratory Approach**

NORHARIATI BINTI ISMAIL

Doctor of Philosophy

February 2018

**THESIS SUMMARY**

Learning and teaching approaches in this 21<sup>st</sup> century have developed significantly, in particular within higher education. The traditional approach of teacher-centred learning is no longer relevant in preparing future employment of engineering graduates to meet the demand of I.R 4.0 and its society. The vision of 'I.R 4.0' is merely aligned with the use of the Active Learning (AL) approach that require the graduates encounter rapid change of technology and world globalization, which provides graduates with necessary skills. Thus, the teacher's role as 'knowledge provider' has changed significantly in the AL environment, as compared to the traditional approach. In addition, AL implementation also gives a considerable challenge to staff beliefs and perceptions about the new teaching and learning process.

As staff are a key component in the success of AL implementation, this study focuses on exploring staff perception of the AL approach particularly within Malaysian Higher Education as a way of assessing staff preparedness. It touches in particular the staff or educators who deal directly with students. Furthermore, the study also intends to examine the staff development requirements in introducing AL within engineering education. Other factors, such as the management and institutional roles that influence staff preparedness for AL implementation are also observed.

This study employs a mixed-methods exploratory approach with qualitative data collection during the initial stage and is followed by a quantitative survey. For qualitative work, two case studies were conducted in which the institutes involved adopted the chosen AL that suited their engineering course curriculum. Using semi-structured interviews, focus groups and document analysis, data in the qualitative approach was gathered in order to explore the staff perceptions, experience as well as the management's and the students' in adopting an AL approach in their learning and teaching methods. The qualitative findings was then used to build the quantitative survey in order to collect data from a larger sample. Data is integrated to present a holistic understanding of staff perceptions with regards to their experience and practices in AL adoption within engineering education in Malaysia.

As this study is the first to be done in order to investigate the staff preparedness with regards to AL implementation, results from this study reveals that failure in managing the change from traditional ethos toward an AL setting has led to the unpreparedness of AL adoption. This is due to the fact that a majority of the staff are unable to understand their role upon AL implementation which led to a variety of implementations due to different understanding and interpretation. Thus, the study manages to identify the key problem that hinders proper implementation with regard to the staff preparation which required holistic involvement in order to achieve the target. Hence, a 'Framework of Managing Change for Active Learning Adoption' is then produced in order to guide the transition involved as well as highlighting the role of relevant stakeholders towards AL implementation. Subsequently, findings of this study may be useful for informing practice, notably in the engineering education community.

Key words: Staff preparedness, Engineering Education, Active Learning

## DEDICATION



*In the Name of Allah, the Most Gracious, the Most Merciful*

This thesis is dedicated to:

**My two sons:** the loves of my life and my personal bodyguards who have always been with me in the UK, who have been my motivation to stay strong, and who have waited patiently by my side while enjoying their school life right up to the last day;

**My parents:** their courage and prayers have comforted me while I was experiencing the stresses and challenges that I faced throughout my PhD life;

**My sisters and brothers:** they have always supported me, even though we have been thousands of miles apart;

And not forgetting ...

**My husband** ... who '*taught me to be **strong***' – I appreciate '*that lesson*' very much.

May Allah bless you all.

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## **LIST OF CONTENT**

THESIS SUMMARY .....	2
DEDICATION .....	3
ACKNOWLEDGEMENTS.....	4
LIST OF CONTENT .....	5
LIST OF ABBREVIATION .....	12
LIST OF TABLES.....	13
LIST OF FIGURES.....	16
<b>CHAPTER 1 : Introduction.....</b>	<b>18</b>
1.1 Introduction .....	18
1.2 Context / Background.....	18
1.3 Statement of the Research Problem.....	22
1.4 The Motivation for the Research Work .....	23
1.5 Declaration of Interest .....	24
1.6 Research Aim and Objectives .....	24
1.6.1 Research Aim .....	25
1.6.2 Research Objectives .....	25
1.7 Operational Terms .....	25
1.8 Dissemination of Work .....	26
1.9 Thesis Outline .....	28
1.10 Summary.....	30
<b>CHAPTER 2 : LITERATURE REVIEW .....</b>	<b>31</b>
2.1 Introduction .....	31
2.2 Active Learning .....	31
2.2.1 What is Active Learning?.....	31
2.2.2 The Characteristics of Active Learning .....	33
2.2.3 The Theoretical underpinning of Active Learning .....	34
2.2.4 The Role of staff / educators in Active Learning environment.....	35
2.2.5 Active Learning in Engineering Education .....	37
2.3 Engineering Education .....	46
2.3.1 Engineering Accreditation Bodies and Requirements.....	47
2.3.2 Engineering Education: - The UK Provision.....	48
2.4 Engineering Education in Malaysia.....	50
2.4.1 Pedagogical approach in Malaysian Engineering Education System...	51
2.4.2 Changes in Malaysian Engineering Education Teaching and Learning	52
2.4.3 Malaysian Accreditation & Requirement.....	53
2.4.4 Active Learning Adoption in Malaysian Higher Education.....	55

2.5	Preparedness and Readiness .....	57
2.5.1	Defining Preparedness and its Implication .....	57
2.5.2	Individual and Organisation Readiness .....	58
2.5.3	Readiness in education innovation.....	59
2.6	Managing Change in Higher Education .....	59
2.6.1	The Role and Effect of Management and Organisational culture.....	60
2.7	Staff Perspective .....	63
2.7.1	Staff Perspective in AL Implementation.....	63
2.7.2	Staff Experience and Engineering Education .....	64
2.7.3	Challenges Faced in AL implementation .....	67
2.8	Staff Development program .....	71
2.8.1	Staff Development Programme for AL Implementation.....	71
2.9	Chapter Summary .....	73
<b>CHAPTER 3 : RESEARCH METHODOLOGY.....</b>		<b>74</b>
3.1	Introduction .....	74
3.2	Research Question .....	74
3.3	Research philosophy.....	75
3.3.1	Constructive Interpretive Perspective .....	75
3.3.2	Researcher's position.....	76
3.4	Conceptual Framework .....	78
3.5	Research Method and Design .....	79
3.5.1	Overview of Qualitative research.....	80
3.5.2	Overview of Quantitative research .....	80
3.5.3	Mixed-Method Research .....	81
3.5.4	Exploratory Sequential Design .....	83
3.5.5	Exploratory Approach and Triangulation .....	84
3.6	Phase One: Qualitative Design .....	84
3.6.1	Case Study .....	85
3.6.2	Selection of Sample .....	89
3.6.3	Sample Size.....	95
3.6.4	Data Collection Method.....	96
3.6.5	Data Recording, Storage and Management .....	98
3.6.6	Document Analysis .....	100
3.6.7	Data Analysis .....	101
3.6.8	Issues of Validity and Reliability .....	105
3.7	Phase Two - Quantitative Design .....	108
3.7.1	The Development of Instrument .....	108

3.7.2	Selection of Sample Participants.....	111
3.7.3	Sampling size.....	111
3.7.4	Data Collection Method.....	113
3.7.5	Data Analysis .....	113
3.7.6	Validity and Reliability for Survey Instrument.....	113
3.8	Ethical issues .....	116
3.8.1	The researcher's side.....	116
3.8.2	State permission .....	117
3.8.3	Institution level .....	118
3.8.4	Participant involved at the research site .....	118
3.9	Research Journey .....	119
3.10	Summary.....	119
<b>CHAPTER 4 : QUALITATIVE FINDINGS FROM CASE STUDY 1 – PBL INSTITUTE</b>		
.....		120
4.1	Introduction .....	120
4.2	Institutes Background.....	120
4.3	Staff Perspective in PBL Implementation: The Academic Experience .....	121
4.3.1	PBL Institute - Staff background and demographic data.....	122
4.3.2	PBL Institute - Staff' perceptions of AL implementation .....	125
4.3.3	PBL Institute – Staff' Perception of Preparedness.....	126
4.3.4	PBL Institute - The Finding Themes from Staff Perspective .....	127
4.3.5	PBL Institute - Challenges faced by staff in PBL implementation.....	143
4.3.6	PBL Institute - Suggestions for improvement by staff .....	146
4.3.7	Summary of Staff Perspective in the PBL Implementation.....	148
4.4	Managements' Perspective in PBL Implementation: The Managements' Experience .....	150
4.4.1	PBL Institute - Managements' background and demographic data....	151
4.4.2	PBL Institute - Management perceptions of AL implementation.....	151
4.4.3	PBL Institute - Management's perception on staff preparedness.....	153
4.4.4	PBL Institute - The Findings Themes from Managements' Perspective 153	
4.4.5	PBL Institute - Challenges Faced by Staff from Management's Perspective .....	159
4.4.6	PBL Institute - Suggestions for Improvement by management .....	161
4.4.7	PBL Institute - Summary of Managements' Perspective in PBL Implementation.....	162
4.5	Students' Perspective in PBL Implementation: Students' Experience.....	164
4.5.1	PBL Institute - Students' background and demographic data .....	164

4.5.2	PBL Institute - Students' perceptions of AL implementation .....	165
4.5.3	PBL Institute - Students' perceptions of staff preparedness .....	167
4.5.4	PBL Institute - The finding themes from students' perspective .....	167
4.5.5	PBL Institute - Challenges faced by students in PBL Implementation	171
4.5.6	PBL Institute - Suggestion for improvement from students' .....	173
4.5.7	Summary of Students' Perspective in PBL Implementation .....	175
4.6	Conclusion for Case Study 1 .....	177
<b>CHAPTER 5 : QUALITATIVE FINDINGS CASE STUDY 2 – WBL INSTITUTE .....</b>		<b>178</b>
5.1	Introduction .....	178
5.2	Background of WBL Institute .....	178
5.3	Staff Perspective in WBL Implementation: The Mentoring Experience .....	179
5.3.1	WBL Institute – Mentors' Background and Demographic Data .....	180
5.3.2	WBL Institute – Mentors' Perceptions of AL Implementation .....	183
5.3.3	WBL Institute - Mentors' Perceptions of Preparedness .....	184
5.3.4	WBL Institute - The Finding Themes from Mentors' Perspective .....	184
5.3.5	WBL Institute - Challenges Faced by Mentors In WBL Implementation 191	
5.3.6	WBL Institute - Suggestions for Improvement by Mentors .....	195
5.3.7	Summary of Mentors' Perspective in WBL Implementation .....	197
5.4	The Management's Perspective in WBL Implementation: The Management's Experience.....	199
5.4.1	WBL Institute - Managements' Background and Demographic Data .	199
5.4.2	WBL Institute - Managements' Perception of WBL Implementation...	201
5.4.3	WBL Institute - Managements' Perception of Staff Preparedness .....	202
5.4.4	WBL Institute - The Finding Themes from Managements' Perspective 203	
5.4.5	WBL Institute - Challenges Faced by Staff From Management's Perspective .....	208
5.4.6	WBL Institute - Suggestion for Improvement by Management.....	210
5.4.7	Summary of Managements' Perspective in WBL Implementation.....	212
5.5	Students' Perspective in WBL Implementation: The Academic Experience 214	
5.5.1	WBL Institute - Students' Background and Demographic Data.....	214
5.5.2	WBL Institute - Students' Perceptions of AL Implementation .....	215
5.5.3	WBL Institute - Students' Perceptions of Staff Preparedness .....	216
5.5.4	WBL Institute - The Finding Themes from Students' Perspective .....	216
5.5.5	WBL Institute - Students' Challenges Faced by the Students in WBL Implementation.....	219
5.5.6	WBL Institute - Suggestions for Improvement by Students.....	221

5.5.7	Summary of Students' Perspective in WBL Implementation .....	222
5.6	Conclusion for Case Study 2 .....	224
<b>CHAPTER 6 : QUALITATIVE ANALYSIS AND KEY FINDINGS.....</b>		<b>225</b>
6.1	Introduction .....	225
6.2	Analysis of Findings for Case Study 1 .....	225
6.2.1	Demographic Analysis for Case Study 1 .....	225
6.2.2	Perception of PBL Implementation .....	229
6.2.3	Perception of Preparedness in PBL Implementation .....	232
6.2.4	Analysis of the Themes for Case Study 1 .....	232
6.2.5	Document Analysis for Case Study 1 .....	240
6.2.6	Summary of Case Study 1 .....	241
6.3	Analysis of Findings for Case Study 2 .....	242
6.3.1	Demographic Analysis of Case Study 2 .....	242
6.3.2	Perception of WBL Implementation .....	246
6.3.3	Perception of Preparedness in WBL Implementation .....	247
6.3.4	Analysis of the Themes for Case Study 2.....	248
6.3.5	Document Analysis for Case Study 2 .....	256
6.3.6	Summary of Case Study 2 Analysis .....	257
6.4	Cross-Case Analysis .....	258
6.4.1	Demographic Analysis .....	258
6.4.2	Perception of AL .....	261
6.4.3	Perception on Preparedness .....	262
6.4.4	Analysis of the Themes .....	262
6.4.5	Challenges Faced in AL implementation .....	268
6.4.6	Summary of Cross-Case Analysis .....	269
6.4.7	Further Analysis .....	271
6.4.8	Summary .....	275
<b>CHAPTER 7 : QUANTITATIVE ANALYSIS AND KEY FINDINGS – COMMUNITY SURVEY .....</b>		<b>276</b>
7.1	Introduction .....	276
7.2	Demographic Data .....	276
7.3	Descriptive Statistic.....	278
7.4	Reliability Analysis .....	294
7.5	Assumptions Regarding Multiple Regressions .....	294
7.5.1	Normality Test.....	295
7.5.2	Linearity Test .....	295
7.5.3	Homoscedasticity Test .....	296
7.5.4	Multi-Collinearity Test.....	297

7.6	Correlation Analysis .....	298
7.7	Regression Analysis.....	299
7.8	Summary of quantitative findings .....	299
<b>CHAPTER 8 : META – ANALYSIS AND TRIANGULATION .....</b>		<b>301</b>
8.1	Introduction .....	301
8.2	Research Question .....	301
8.3	Summary of the Analysis.....	315
<b>CHAPTER 9 : DISCUSSION .....</b>		<b>317</b>
9.1	Introduction .....	317
9.2	Research Overview .....	317
9.3	The Major Findings of the Research.....	318
9.4	Discussion of Key Findings .....	319
9.4.1	Staff Perception .....	319
9.4.2	Factors Influencing Staffs’ Preparedness Towards AL Implementation 320	
9.5	Development of Framework .....	330
9.5.1	The structure of the framework.....	333
9.6	Conclusion .....	339
<b>CHAPTER 10 : CONCLUSION.....</b>		<b>341</b>
10.1	Introduction .....	341
10.2	Answering the Research Questions and Achieving the Research Aim and 341	
	Objectives.....	341
10.3	Research Contributions.....	344
10.3.1	Contribution to Knowledge .....	344
10.3.2	Contribution to Practice.....	345
10.4	Research Limitations.....	346
10.5	Recommendations for further Research.....	347
10.6	Summary.....	347
<b>REFERENCE .....</b>		<b>348</b>
<b>APPENDICES .....</b>		<b>364</b>
	Appendix 1: The 4 <sup>th</sup> International Research Symposium on Problem Based Learning (IRSPBL, 2013) - Review Paper.....	364
	Appendix 2: The 1 <sup>st</sup> Engineering Education Research Special Interest Group (EER SIG, 2013) - Poster Presentation .....	372
	Appendix 3: 2015 Research in Engineering Education Symposium (REES 2015) – Conference Paper.....	373
	Appendix 4: Engineering Education Research Network Symposium 2015 – Abstract Submission .....	382

Appendix 5: Aston STEM Education Centre 2016 (ASEC) – Poster Presentation	383
Appendix 6: List of Subjects That Adopt AL Approach .....	384
Appendix 7: Example of Interview Transcript .....	385
Appendix 8: Example of Coding.....	399
Appendix 9: Sample of Quantitative Questionnaire .....	400
Appendix 10: Ethical Approval by Aston University .....	408
Appendix 11: Letter of Consent.....	409
Appendix 12: Application Letter and Approval Letter to Conduct Data Collection	410
Appendix 13: Participant Information leaflet & Consent Form .....	420
Appendix 14: Data Collection Journey .....	425
Appendix 15: Interview Protocol for Staff (Lecturer) .....	444
Appendix 16: PBL Institute - Thematic Network Analysis for Staff.....	452
Appendix 17: Interview Questionnaires for Management .....	456
Appendix 18: PBL Institute - Thematic Network Analysis for Management .....	461
Appendix 19: Focus Group Questionnaires for Students.....	465
Appendix 20: PBL Institute - Thematic Network Analysis for Student.....	470
Appendix 21: WBL Institute - Thematic Network Analysis for Staff (Mentor) .....	472
Appendix 22: WBL Institute - Thematic Network Analysis for Management .....	474
Appendix 23: WBL Institute - Thematic Network Analysis for Student.....	476
Appendix 24: Detail of Mean Score for Each Variables .....	477

## LIST OF ABBREVIATION

AL	Active Learning
ALL	Activity Led-Learning
BEM	Board of Engineers, Malaysia
CDIO	Conceive-Design-Implement-Observe
CPBL	Cooperative Problem-Based Learning
EAC	Engineering Accreditation Council
EE	Engineering Education
GMI	German-Malaysian Institute
HE	Higher Education
HOD	Head of Department
ICT	Information and Communications Technology
IT	Information Technology
IEM	Institute of Engineers, Malaysia
MCED	Malaysian Council of Engineering Dean
MOHE	Ministry of Higher Education
MQA	Malaysia Qualification Agency
MQF	Malaysian Quality Framework
OBE	Outcome Base Education
PBL	Problem-Based Learning
PjBL	Project-Based Learning
POPBL	Project-Oriented and Problem-Based Learning
SCL	Student-Centred-Learning
TTO	Technical Training Officer
TVET	Technical, Vocational and Education Training
UiTM	Universiti Teknologi MARA
UKM	Universiti Kebangsaan Malaysia
UM	Universiti Malaya
UPM	Universiti Putra Malaysia
UTHM	Universiti Tun Hussein Onn Malaysia
UTM	Universiti Teknologi Malaysia
WBL	Work-Based Learning

## LIST OF TABLES

Table 1.1 Eight domains of learning outcomes by MQF (MQF, 2011) .....	20
Table 2.1: Characteristics of Traditional Learning and Problem-Based Learning (PBL). Adapted from Barrows (1996) cited in Grigg & Lewis (2013) .....	39
Table 2.2: Summary of Comparison on Active Learning Discussed.....	45
Table 2.3: Engineering Accreditation Bodies Adapted from Hind and Soumia (2017). .....	48
Table 2.4: Engineering Attributes Outlined by EAC Malaysia (EAC, 2012) .....	54
Table 3.1: Case Study Location .....	91
Table 3.2: The Fundamental Difference Between WBL and PBL Approach .....	92
Table 3.3: Participants Involved in Case Studies Conducted.....	94
Table 3.4: Target Number of Participants Per Case Study .....	96
Table 3.5: Table of Determination of Total Sample by Krejcie and Morgan (1970) .	112
Table 3.6: Table of Determination of Total Sample by Cohen (1992) .....	112
Table 3.7: Reliability Coefficient for Variable .....	116
Table 3.8: Personal Code Of Practice: For Negotiating Access, Following Ethical Guidelines And The Problems Of 'Inside' Research .....	117
Table 4.1: Staff Profile and Background .....	123
Table 4.2: Staff perception of their preparedness .....	126
Table 4.3: Summary of Staff Practice and Experience within PBL Environment .....	149
Table 4.4: Summary of Staff's Perception of Their Preparedness Based on Finding Themes.....	149
Table 4.5: Challenges Faced by Staff in PBL Implementation .....	150
Table 4.6: Participants' Profiles for Management .....	151
Table 4.7: Summary of Management's Perspective within the PBL environment....	162
Table 4.8: Summary Of Management's Perception On The Staff Preparedness Based on Finding Themes.....	163
Table 4.9: Summary of Challenges in PBL Implementation from Management's Perspective .....	163
Table 4.10: PBL Institute – Participant's Background For Student.....	165
Table 4.11: Summary of Students' Experience in PBL Environment.....	176
Table 4.12: Summary of Student's Perception on the staff Preparedness Based on Finding Themes .....	176
Table 4.13: Summary of Challenges Face by Students In PBL Implementation .....	176
Table 5.1: Mentors' Profile and Background .....	180

Table 5.2: Summary of Mentors' Practice and Experience within the WBL environment .....	197
Table 5.3: Summary of Mentors' Perception of Their Preparedness Based on Finding Themes .....	198
Table 5.4: Challenges Faced by Mentors in WBL Implementation.....	198
Table 5.5: Participant Profiles for Managements (WBL Institute) .....	200
Table 5.6: Summary of Managements' Practice and Experience within the WBL environment .....	213
Table 5.7: Summary of Managements' Perception on the Mentors' Preparedness Based On Finding Themes.....	213
Table 5.8: Summary of Challenges in WBL Implementation From Management's Perception.....	213
Table 5.9: WBL Institute - Participants Background for Students.....	215
Table 5.10: Summary of Students' Experience in WBL Implementation .....	223
Table 5.11: Summary of Students' Perception on Mentors' Preparedness Based on Finding Themes .....	223
Table 5.12: Summary of Challenges Faced by Students in WBL Implementation...	223
Table 6.1: Analysis of Staff and Management Demographic .....	226
Table 6.2: Analysis of Focus Group Demographic.....	228
Table 6.3: Summary of the Themes Derived from Participants.....	233
Table 6.4: Case Study 1- Summary Of Themes Derived For Staff Preparedness From Three Different Participants Involved.....	241
Table 6.5: Analysis of Staff's and Management's Demographic.....	243
Table 6.6: Analysis of Focus Group Demographic.....	245
Table 6.7: Summary of the Themes Derived from Participants.....	249
Table 6.8: Case Study 2- Summary of Themes Derived for Staff Preparedness from Three Different Participants Involved.....	257
Table 6.9: Analysis of Staff's and Management's Demographic.....	259
Table 6.10: Analysis of Focus Group Demographic.....	261
Table 6.11: Analysis of the Themes Derived from Both Case Studies .....	263
Table 6.12: Challenges Faced Highlighted by Each Participants in Case Study 1 & Case Study 2.....	268
Table 6.13: Summary of Practice and Experience for Both Case Study .....	269
Table 6.14: Summary on Analysis of Findings for Both Case Study Conducted .....	270
Table 6.15: Summary of Analysis on Challenges Face from Both Case Study .....	271
Table 6.16: Selected Themes That Required Further Refinement .....	272
Table 6.17: Final Theme Derived .....	273

Table 6.18: Summary of the Challenges Based on the Final Themes Derived .....	273
Table 6.19: Summary of the 10 Themes Derives from Qualitative Study. ....	275
Table 7.1: Summary of Demographic Data.....	276
Table 7.2: Current Position as Their First Job.....	277
Table 7.3: Work in Engineering Field Before Joining Education .....	277
Table 7.4: Working Duration at Current Institute .....	278
Table 7.5: Level of Mean Value (Adapted from Hair et al., 2006).....	278
Table 7.6: Overall Results from Descriptive Analysis of the Variables Table .....	279
Table 7.7: Frequency of Observation on Staff Perception with Regard to AL Implementation.....	280
Table 7.8: Frequency of observation on Motivation to Adopt AL Approach.....	281
Table 7.9: Frequency of observation on Staff Understanding on AL Implementation .....	282
Table 7.10: Frequency of observation on Staff Attitude on AL Implementation .....	283
Table 7.11: Frequency of observation on Training for AL Implementation .....	284
Table 7.12: Frequency of observation on Teaching & Planning for AL implementation .....	286
Table 7.13: Frequency of Observation on Facilities for AL Implementation .....	287
Table 7.14: Frequency of Observation on Management Support for AL Implementation .....	289
Table 7.15: Frequency of Observation on Colleague Support for AL Implementation .....	291
Table 7.16: Frequency of Observation on Challenges Face in AL Implementation .	292
Table 7.17: Reliability Coefficient for Variable .....	294
Table 7.18: Skewness and Kurtosis for the Variables.....	295
Table 7.19: Multi-Collinearity Test .....	298
Table 7.20: Correlation analysis on Preparedness with regards to Training, Management Support and Institution Culture.....	299
Table 7.21: Effect of Training, Management Support and Institution Culture on Preparedness.....	299

## LIST OF FIGURES

Figure 2.1: The Ten Challenges and Three Growing Stages of Profound Change (adapted from Senge (1999)) .....	62
Figure 3.1: Conceptual Framework .....	78
Figure 3.2: Exploratory Sequential Design (adapted From Creswell, 2009).....	83
Figure 3.3: Multiple-case study design (Modified and Adapted form Yin, 2014).....	88
Figure 3.4: Interview data collecting process (Author) .....	100
Figure 3.5: Structure of a Thematic Network (derived from Attride-Stirling, 2001) ..	103
Figure 3.6: Steps in Thematic Analysis Network (derived from Attride-Stirling, 2001) .....	104
Figure 4.1: Model of Pro3BL With the Education Outcomes Chosen by PBL Institute .....	121
Figure 4.2: Staff's Academic Qualification .....	124
Figure 4.3: Staff's Experience in Teaching .....	124
Figure 4.4: Staff's Perception on AL Implementation .....	126
Figure 4.5: Staff Response to Their Preparedness .....	127
Figure 4.6: PBL Institute - Seven Main Themes Emerge on the Staff Preparedness Based from Staff Perspective .....	129
Figure 4.7: Staff - Main Theme and Sub-themes for Understanding .....	130
Figure 4.8: Staff - Theme and - Sub-themes for Training.....	132
Figure 4.9: Staff - Theme and Sub-themes for Leadership .....	134
Figure 4.10: Staff - Theme and Sub-themes Staff's Character / Attitude.....	135
Figure 4.11: Staff - Theme and - Sub-themes for Support .....	136
Figure 4.12: Staff - Theme and - Sub-themes for Facilities.....	139
Figure 4.13: Staff - Theme and - Sub-themes for Learning Cultures.....	141
Figure 4.14: Challenges Faced by Staff in PBL Implementation .....	144
Figure 4.15: Suggestion for improvement by Staff .....	147
Figure 4.16: PBL Institute - Eight Main Themes Emerge on the Staff Preparedness Based from Management Perspective.....	154
Figure 4.17: Challenges Faced by Staff from The Management's Perspective .....	160
Figure 4.18: PBL Institute - Five Main Themes Emerge on the Staff Preparedness Based from Students' Perspective.....	168
Figure 4.19: Challenges Faced by Students in PBL Implementation .....	171
Figure 4.20: PBL Institute - Suggestions for improvement from Students Perspective .....	174
Figure 5.1: Hierarchy and sites of WBL implementation .....	179

Figure 5.2: Mentors' Academic Qualifications .....	182
Figure 5.3: Mentors' Working Experience .....	182
Figure 5.4: WBL Institute - Five Main Themes Emerge on the Mentors Preparedness based from Mentors' Perspective .....	185
Figure 5.5: Mentor - Theme and Sub-themes for Understanding .....	186
Figure 5.6: Mentor - Theme and - Sub-themes for Unclear Direction.....	187
Figure 5.7: Mentor - Theme and Sub-themes for Unclear Syllabus .....	188
Figure 5.8: Mentor - Theme and - Sub-themes for Attitude.....	189
Figure 5.9: Mentor - Theme and Sub-themes for Skill .....	190
Figure 5.10: Mentor - Theme and Sub-themes for Communication .....	191
Figure 5.11: Challenges Faced by Mentor in WBL Implementation .....	192
Figure 5.12: Suggestion for Improvement from Mentor.....	195
Figure 5.13: Management Hierarchy of WBL Implementation.....	199
Figure 5.14: WBL Institute - Five Main Themes Emerges on the Staff Preparedness Based from Managements' Perspective .....	204
Figure 5.15: WBL Institute - Challenges Faced by Mentors from Management's Perspective .....	208
Figure 5.16: Suggestions for Improvement from WBL Management.....	211
Figure 5.17: WBL Institute - The Finding Themes from the Students' Perspective .	217
Figure 5.18: Challenges Faced by Students During WBL.....	219
Figure 5.19: Suggestions for Improvement from Students' Perspective.....	221
Figure 6.1: Participants' Perception in AL Implementation.....	229
Figure 6.2: Negative Responses Highlighted by Participants.....	230
Figure 6.3: Distribution of Frequency of Theme Discussed.....	235
Figure 6.4: Frequency Analysis for Management .....	252
Figure 7.1: Scatterplots Of Standardized Residuals Against The Predicted Values Of Linearity Test.....	296
Figure 7.2: Scatterplots of Standardized Residuals Against the Predicted Values of Homoscedasticity Test. ....	297
Figure 9.1: Biggs's Theory of Constructive Alignment (adapted from Biggs, 1999).	324
Figure 9.2: Framework of Managing Change for AL Adoption Process (Author).....	332

## **CHAPTER 1 : INTRODUCTION**

### **1.1 Introduction**

This chapter presents an overview of the thesis by providing the background and motivation of the researcher to undertake this research based on her ontology and epistemology. Following this, the next section outlines the research questions, aim and objectives of the study. The operational terms used are then presented, as well as the dissemination of work during the study, before concluding with the outline of the chapters that comprise this thesis.

### **1.2 Context / Background**

The research is aimed at investigating the staff (educator) preparedness for Active Learning (AL) implementation in Malaysian higher education, particularly within engineering education.

Preparedness as defined by Hay, Smit & Paulsen (2001) refers to how well someone (in this case a teacher) possesses a 'state of readiness' for something that is imminent with regard to skills, cognitive understanding as well as their emotional level. Bolyard & Moyer-Packenham (2008) relates teacher preparedness as a continuous process of self-renewal and professional development, where the teacher works to influence and improve the quality of one's own knowledge of content and pedagogy. In relation to preparedness, Martin (2010) asserts that content knowledge and pedagogical knowledge are two important factors that contribute to the preparedness of teachers. For the context of this study, preparedness is defined as the competencies required of staff (educators) to attain the educational goal of successfully implementing AL approach, particularly with regards to knowledge, skills and cognitive understanding.

Active Learning (AL) can be distinguished from traditional methods in that they require students to play an active role in constructing knowledge (Prince, 2004). Bonwell and Eison (1991) define AL as a strategy encompassing a variety of collaborative classroom activities that require students to be engaged with the course material. Prince and Felder (2006) add that AL activity may involve a complex real-world problem to solve, a case study to analyse or some experimental data to interpret rather than teaching the students fundamental ideas and theories. In other words, AL

activity requires students to be responsible for their own learning by applying the knowledge and their skill meaningfully to a situation as compared to the more deductive traditional approach where students passively receive information from the teacher (Kudryashova, Gorbatova, Rybushkina, & Ivanova, 2016). In supporting the employment of an AL approach, many studies have shown that AL encourages deep learning and also improves students' competencies, such as critical thinking, problem solving, creativity, communication skills and collaborative skills (Kudryashova et al., 2016; Adams, Kaczmarczyk, Picton & Demian, 2011; Rojter, 2009; Tandogan & Orhan, 2007; Prince & Felder, 2006). Thus, the use of AL, particularly within engineering education at a higher level has spread to a diverse range of courses, which include electronic engineering, mechanical engineering, chemical engineering and general engineering (Adams et al., 2011; Ambikairajah & Epps, 2011; Ariffin et al., 2004; Armstrong, Cunningham, & Hermon, 2005). With regards to this, there are several 'named' AL approaches that are commonly applied in engineering education such as Problem-Based Learning (PBL), Project-Based Learning (PjBL), 'Conceive, Design, Implement and Operate' (CDIO), Work-Based learning (WBL) and others (Ariffin et al., 2004; Kaikkonen & Lahtinen, 2011).

The introduction of AL within a Malaysian higher education scenario began when the issue of graduate employability was raised by industry, as many engineering graduates were not considered to be employable and in possession of the required competencies (Hanapi et al., 2015; Hanapi & Nordin, 2014; Singh & Singh, 2008; Zaharim et al., 2009). The traditional teaching approach that only provides theoretical and fundamental knowledge of engineering without non-technical skills is no longer relevant in order to supply quality talent to industry when there is a changing economic structure in Malaysia (Hanapi & Nordin, 2014; Woo, 2013; Phang, Yusof & Samah, 2013). Among the non-technical skills highlighted that the engineering graduates are lacking the ability to communicate effectively, problem solving and poor interpersonal skills. With regards to these issues, several researchers have highlighted the need for engineering education in Malaysia to be reviewed and reassessed in terms of the teaching and learning particularly at the tertiary level (Hanapi et al., 2015; Hashim & Din, 2009; Zaharim et al., 2009). This is to ensure that the curriculum and learning approach used at the tertiary level will provide the graduates with the necessary skills and competencies as demanded by industry.

In response to the issues concerning engineering graduates, the Malaysian Ministry of Higher Education (MoHE), Engineering Accreditation Council (EAC), the

Board of Engineers Malaysia (BEM), and the Malaysian Qualification Agency (MQA) has made mandatory for engineering education in Malaysia to adopt Outcome-Based Education (OBE) (Mamat, Rasul, & Mustapha, 2014; Hashim & Din, 2009; Mohayidin et al., 2008; Mohammad et al., 2008; Aziz et al., 2005). Hence, the introduction of OBE has indirectly nurtured AL implementation in higher education institutions. This is due to the fact that the traditional approach to teaching, which is teacher-centred, is considered no longer sufficient for graduates in order to achieve the learning outcomes as outlined by the Malaysian Quality Framework (MQF) and as shown in Table 1.1 below. Therefore, the changes within the Malaysian higher education system from passive learning to an active learning environment has been an essential contributing factor to the curriculum transition in order to improve graduate competencies and employability skills particularly within engineering education.

Table 1.1 Eight domains of learning outcomes by MQF (MQF, 2011)

No	Learning Outcomes
1	Knowledge
2	Practical skills
3	Social skills and responsibilities
4	Values, attitudes, and professionalism
5	Communication, leadership, and team skills
6	Problem solving and scientific skills
7	Information management and lifelong learning skills
8	Managerial and entrepreneurial skills

As the introduction of AL at the tertiary level has captured the interest among Malaysian educators to adopt the approach, the adoption is seen to be based on individual initiatives which focus on selected courses rather than a full institutional adoption. For instance, the use of PBL in engineering education in Malaysia was first initiated back in 2002 by the Department of Chemical Engineering at Universiti Teknologi Malaysia (UTM) where it later adopted Cooperative PBL (CPBL) in 2010 (Mohd-Yusof et al., 2011). Other institutes that also embraced PBL in their engineering courses were later recorded, an example being University Malaya (UM) in the Department of Electrical Engineering in 2003 (Said et al., 2005). In 2005, several

faculties in University Tun Hussein Onn Malaysia (UTHM) started to adopt a PBL approach in the Faculty of Civil and Environmental Engineering, as well as the Faculty of Electronics and Electrical Engineering (Salleh, Othman, Esa, Sulaiman, & Othman, 2007). Aside from PBL, Community Colleges had offered a few Work-Based Learning (WBL) programmes followed by selected polytechnics in 2010 (Rasul & Yasin, 2014). In 2009, Yasin, Mustapha and Zaharim (2009) put an initiative to introduce Problem-Oriented Project-Based Learning (POPBL) into the engineering programmes at several Malaysian polytechnics as an effort to improve the quality of the graduates produced.

With regards to AL implementation, several research studies have been done to explore the implementation of AL within a Malaysian higher education setting (Borhan, 2012; Hashim & Din, 2009; Yusof et al., 2005). Studies done on the reflections from students show positive feedback with regards to the implementation as they discovered that solving problems and group discussion does help the students to appreciate the knowledge gained despite the situation that perceive having more to do compared to a more traditional approach to teaching (Borhan, 2012; Yusof et al., 2005). Hence, the AL approach benefits the students in terms of team-work and appreciating how active learning is more representative of the industry context. In addition to this, the AL approach allows creative thinking as well as developing professional skills in tackling complex, interdisciplinary problems (Borhan, 2012; Nopiah et al., 2008). Other reports also added that with AL adoption within an engineering curriculum, the approach manages to enhance the generic skills required by industry and inculcate a positive attitude and confidence during the group projects conducted (Napiah et al., 2008; Salleh et al., 2007).

From the staff perspective, initially they were sceptical that the AL implementation could be an effective method of teaching as most of the educators in Malaysia are also from a traditional teacher-centered approach and are more familiar and comfortable with didactic lecturing (Hashim & Din, 2009; Yusof et al., 2005; Ariffin et al., 2004). The majority of them are also afraid and not confident in adopting AL as they have never experienced the approach before (Yasin et al., 2009; Salleh et al., 2007; Yusof et al., 2005). In addition, staff also highlighted that the AL approach demands additional work prior to the learning session which is different from just preparing lecture notes. However, after attending a series of training courses, the staff gain a better understanding and acknowledge that the AL approach is an ideal teaching method for engineering courses despite admitting that preparation for the AL approach

is quite challenging and this may consequently affect the staff preparedness when implementing the approach efficiently (Salleh et al, 2007; Yusof et al., 2005).

### **1.3 Statement of the Research Problem**

The use of Active Learning has been accepted for more than 30 years since the introduction of Problem Based Learning (PBL) in the medical curriculum at McMasters University, Canada in the 1960s (Akınoğlu & Tandoğan, 2007; Hung, Jonassen, & Liu, 2008). Since then, the approach has been widely used in other disciplines, such as engineering, pharmacology, psychology, business studies and many others (Bouhuijs, 2011; Hung et al., 2008). Using problems as a driving factor in the learning process, students work alongside group members and educators to find solutions. Other approaches which are based upon the concept of AL, such as Inquiry-Based Learning, Project-Based Learning, Collaborative Learning, CDIO, etc. share the same aim of enhancing students' competencies and skills.

Although these different approaches are implemented in Higher Education (HE) worldwide, adapting new approaches for the institutional curriculum is not easy. As academic staff are identified as important stakeholders who play a significant role in successful AL implementation, they must be able to understand what is expected of them within an AL context (Kudryashova et al., 2016; Keyser, 2000). In other words, the changes to encourage an AL approach must start with a full understanding on the part of the academic staff, if they are to work with AL effectively. Hence, it is necessary to ensure that the staff are well equipped with different kinds of knowledge and skills from those needed for traditional approaches in order to manage the changes required (Bouhuijs, 2011).

With regards to AL implementation experience in a Malaysian education scenario, study by Borhan (2011) highlighted an issue of readiness upon introduction of an AL approach within Malaysian tertiary education. Issues such as a lack of awareness and experience are seen to be among the main challenges raised in AL implementation. A problem highlighted by Mohammad et al. (2012) is not getting the commitment from the staff who are comfortable with the traditional approach hindering the implementation despite various attempts to promote the innovative AL approach. In addition, insufficient training on the knowledge and skills required for a successful AL implementation is identified as one of the main consideration that can jeopardise proper AL implementation (Zin, Williams & Sher, 2015; Yasin et al., 2009). The issue

of insufficiently long time frames allow for the change to take place also need to be considered as the changes cannot be carried out instantaneously (Ishak, Omar, & Sum, 2015; Hashim & Din, 2009; Yusof et al., 2004). Finally, Hanapi et al (2015) asserts that a lack of proper equipment relevant to the teaching and learning process is one of the challenges that weakens the staff commitment in integrating technical and employability skills among students during the AL implementation.

For these varied reasons, this study focuses on the staff perceptions of their preparedness for Active Learning implementation within a Malaysian engineering education scenario. Thus, this study aims to understand how the staff respond to the requirements of preparing themselves for teaching and learning in an AL environment which requires them to change their role from a teacher to a facilitator. There is a gap in the knowledge about this area; as few studies have looked at how prepared staff are to teach AL in engineering education, especially in the Malaysian higher education context. Ultimately, this study will add to academic knowledge about preparing staff more effectively for facilitating in an AL environment.

#### **1.4 The Motivation for the Research Work**

The topic for the present study came from the researcher's desire to contribute to the Outcome-Based Education (OBE) introduced by the Malaysian Qualification Agency (MQA) for higher education, particularly in engineering. This approach has significantly increased awareness among higher education institutes of the need to adopt an AL environment instead of utilizing a passive learning oriented traditional teaching style currently provided in the Malaysian education system.

In her current academic position at one of the engineering institutes in higher education in Malaysia, the institution's mission to align teaching approach with current engineering education demand has brought the opportunity for the researcher as well as encouragement to pursue this area of research. In addition to this, as the researcher is sponsored by the Malaysian Government, she herself as an engineering educator has an ideal opportunity to study and contribute to the future of Malaysia's education system. This is aligned with Malaysia's target of being a developed nation by the year 2020 (Ministry of Education, 2015). To meet the nation's needs, the education institutes should play a vital role in Malaysia's growth by producing a technically skilled, knowledgeable, creative and well-trained workforce. Hence, the contribution of this

study is important in order to prepare a strong foundation and platform at higher education institutions in order to produce graduates with high competence.

Moreover, the researcher's personal experience and background in the engineering field also contribute to her understanding of the educational requirements of engineering. With today's demand for 21<sup>st</sup> century skills as well as towards I. R 4.0, engineering graduates are required not only to be knowledgeable, but also to possess technical competency as well as social competencies such as critical thinking, problem solving, creativity, and other soft skills. Hence, the adoption of AL in teaching and learning in higher education contexts is a positive approach to produce competent graduates. The changes required to encourage an AL approach must start with full understanding from the academic staff, if they are to work effectively in an AL environment. The staff are a key factor in the successful implementation of AL since they, together with the curriculum, play a major role in ensuring good student performance in the classroom.

### **1.5 Declaration of Interest**

In conducting this research work, it is important to highlight that the researcher is currently attached to a PBL Institute as an engineering educator. Having an interest in helping the institute where she has been working, the opportunity to conduct this research work is done in order to better improve the institute's learning and teaching approach. In addition to this, the selection of the institute (PBL Institute) as one of the case study sites may help the researcher to better understand the issues and challenges faced in implementing AL with regards to the Malaysian higher education system, particularly within engineering education. Hence, the researcher believes that the findings from this research work will provide meaningful information to better improve AL adoption at the PBL institution that she works with in particular, and also informing the findings within the engineering education community.

### **1.6 Research Aim and Objectives**

The purpose of this study is to achieve the following research aim and objectives.

### **1.6.1 Research Aim**

The aim of this research is to investigate Higher Education staff preparedness with regard to introducing an Active Learning (AL) approach within Malaysian engineering education. As academic staff are the key component of AL implementation, a 'Framework of Managing Change for Active Learning Adoption' will be designed to guide and provide information for the implementation.

### **1.6.2 Research Objectives**

The objectives of this study are:

- a) To analyse staff perceptions with regards to AL implementation.
- b) To investigate factors that influence staff preparedness in AL implementation
- c) To analyse staff developmental requirements in introducing AL in engineering education.
- d) To analyse the influence of organisation leadership towards staff preparedness in Active Learning implementation
- e) To analyse the influence of institutional culture towards staff preparedness in Active Learning implementation.
- f) To investigate the challenges faced by staff with regards to AL implementation.

### **1.7 Operational Terms**

The key terms used in this study are as follows:

#### **Staff perspectives**

Many studies of AL have been conducted from the student's perspective, whilst other studies have focused on the staff perspectives in their role as AL teacher / educator. This study looks at staff perceptions of their preparedness to teach using the AL approach. In the course of this study, any additional issues arising in the implementation and sustaining of AL, such as management, educational culture, and teacher/staff perceptions, will also be discussed.

Throughout the research, the lecturer/mentor/educator members who took part in AL activities in this study will be referred to as the staff.

### **Active Learning (AL)**

For the purpose of this study, Active Learning (AL) is defined as any of the teaching and learning methods that use a constructive approach to the learning process. It may involve student-centred, collaborative and small-group learning.

### **Preparedness**

The Oxford English Dictionary defines 'preparedness' as a state of readiness (Dictionary, 2002). A broader definition of preparedness used in this study is 'the consideration of AL's effect on staff understanding of their role in the learning process'. The experiences and interactions between the staff/educator and students are the focus of this study. It bases the term 'preparedness' on staff competence to attain the educational goals as defined by the AL philosophy.

### **1.8 Dissemination of Work**

Below are the list of works that have been published by researcher during study period:-

1. A literature review paper entitled "Defining Vocational Education and Training for Tertiary Level Education: Where does Problem Based Learning Fit In? – A Literature Review" was presented at the 4<sup>th</sup> International Research Symposium on Problem Based Learning, in Putrajaya, Malaysia on 2<sup>nd</sup> July, 2013. This paper supports the use of PBL as one of the AL approaches in engineering education at a tertiary level, in particular for technical, vocational and education training (TVET). The paper has also been published in PBL Across Cultures (Mohd-Yusof et al., 2013) (Appendix 1).
2. A poster presentation entitled "A Curriculum Model for the Sustainability of Active Learning at the Tertiary Level" was presented during the 1<sup>st</sup> Engineering Education Research Special Interest Group (EER SIG) Symposium, at Loughborough University on 18<sup>th</sup> June, 2013 (Appendix 2).

3. Upon data collection, a conference paper entitled “How Prepared are Engineering Educators to Implement Active Learning?” – The Emerging Findings” (Appendix 3) was presented during the 2015 Research in Engineering Education Symposium (REES 2015) at Dublin Institute of Technology on 13th July, 2015.
4. Another finding from the research study conducted was presented during the Engineering Education Research Network Symposium 2015 at Cambridge University on 6<sup>th</sup> November, 2015, and was entitled “Defining a Work-Based Learning Approach in Engineering Curriculum – The Emerging Findings” (Appendix 4).
5. A poster presentation that encapsulates this research work entitled “An Analysis of Staff Perceptions of their Preparedness for the Implementation of Active Learning in Malaysian Engineering Education: A Qualitative Approach” (Appendix 5), was presented during the launch of Aston STEM Education Centre (ASEC), which was one of the internal activities initiated by Aston University on 6<sup>th</sup> June 2016.
6. Upon PhD completion, the researcher also plans to disseminate this research finding into various methods as an academic contribution made to the engineering education community. For instance, as dissemination of results is part of the academic process, the dissemination through publication of journals is the main aim as the information can be shared within the target community particularly within engineering education globally as well as locally. In addition to this, the findings from this research work can be shared by presenting papers at conferences or seminars with respective audiences. As this research work is sponsored by the current institute where the researcher is working, it is an obligation to submit a report on work done as evidence that the researcher has completed her PhD study. Apart from that, the thesis can be uploaded via the institution’s electronic archive where other users have access to it and can read it. Hence, the researcher hopes that the dissemination of this work may translate the research findings into practice particularly within engineering education.

## **1.9 Thesis Outline**

This thesis is organised into nine main chapters and the following description provides the summary of each chapter presented in this thesis.

### **Chapter 1: Introduction**

This first chapter provides the introduction to the study conducted and highlights the background and motivation to conduct this study. It also describes the research aim and objectives as well as the operational terms used in this study before highlighting on dissemination of work done throughout this PhD.

### **Chapter 2: Literature Review**

This chapter provides a review of the literature that relates to AL, engineering education in Malaysia, the relationship between preparedness, and managing change in AL implementation as well as the staff development programs that are associated with the AL implementation.

### **Chapter 3: Research Methodology**

This chapter details the methodology adopted to conduct the study and so help answer the research questions. The methodology is discussed in relation to the research philosophy informing this research study. This chapter also offers a detailed explanation on both qualitative and quantitative methods used for the data collection process as well as research instruments before moving on to explain the approach taken to data analysis. In addition, the chapter also highlights the ethical issues and the research journey that relates to the study conducted.

### **Chapter 4: Qualitative Findings - Case Study 1**

This chapter presents the qualitative findings from Case Study 1 conducted at the PBL Institute. The presentation of the chapter starts with the background of the institute, before presenting the findings based on three main stakeholders involved in the study, namely the staff, management, and the students. Challenges and suggestions for improvements are also outlined in relation to the case study conducted.

### **Chapter 5: Qualitative Findings - Case Study 2**

This chapter presents the qualitative findings for Case Study 2 conducted at WBL Institute based on the AL used by their institute. The chapter starts with the background of the institute before presenting the findings from the three main stakeholders involved

as per Case Study 1. Challenges and suggestions for improvements are also outlined in relation to the case study conducted.

#### Chapter 6: Qualitative Analysis and Key Findings

This chapter examines the analysis (within-case and cross-case analysis) done for both the case studies conducted. This section also deduces the finding themes from both case studies in the qualitative phase into final themes where the emerging themes are used to develop survey questions for quantitative study.

#### Chapter 7: Quantitative Analysis and Key Findings - Community Survey

This chapter presents the quantitative findings conducted during the second phase of data collection. The chapter starts with demographic data of participants followed by results from descriptive findings as well as analysis conducted.

#### Chapter 8: Meta-Analysis and Triangulation

This chapter provides analysis from both qualitative and quantitative findings based on the research questions that outline this research work. The analysis is done based on themes derived with the quantitative findings to validate the data in the qualitative phase earlier. In addition to this, relevant literature is used to triangulate the findings for the work done.

#### Chapter 9: Discussion

This chapter provides discussion of the findings from both qualitative and quantitative phase done and justified through reference to previous literature. This chapter also encloses the framework derived from the research work conducted.

#### Chapter 10: Conclusion

This final chapter concludes the research work done by answering the research question as well as addressing contributions of the work done. It also provides the limitations of the research work conducted and some recommendations for future research.

## **1.10 Summary**

In summary, this chapter has provided the study's background, motivation, research questions, aim and objectives as well as intended outcomes of the research work. This chapter also presented the work completed throughout the duration of the study; finally, the overall structure of the thesis was outlined. The following chapter will focus on a review of the literature that provided information and nurtured this study.

## **CHAPTER 2 : LITERATURE REVIEW**

### **2.1 Introduction**

The literature review for this study will focus on staff's perception and readiness vis-à-vis the application of Active Learning (AL) in engineering education at Higher Education (HE). The review starts by describing AL in the engineering education context as a teaching and learning process where the role of the staff is highlighted in an AL setting. AL adoption is further explained by its functions and numerous approach that are commonly used within engineering education. In addition, the review addresses major changes required in implementing an AL approach with particular reference to curriculum in higher education institution by looking at The UK engineering education setting. This includes the role of accreditation body in providing guidelines for higher education institution, particularly for engineering courses. The literature continues with an overview of Malaysian engineering education system and how Malaysia higher education institution introduces the AL approach for their engineering education. In support of this study, the review then identifies the concept of preparedness to discuss how an organisation gets ready for changes related to innovation in education. These include interrelated aspects such as individual staff, the institutional culture and management leadership to support the implementation of the new approach and the ultimate impact that these factors have on successful implementation of the approach. Finally, there is a review of the literature on staff development programs which should precede AL implementation.

### **2.2 Active Learning**

#### **2.2.1 What is Active Learning?**

Active Learning (AL) is defined as instructional activities which require students to do things and also to think about what they are doing (Bonwell & Eison, 1991). This is in contrast to teaching which uses traditional lecture methods, in which professors talk and students listen (Bonwell & Eison, 1991; Prince, 2004). Chickering, Gamson, and Poulsen (1987) argued that, in AL, students must do more than merely listen. In addition, Allen and Tanner (2005) defined AL as "seeking new information, organizing it in a way that is meaningful and having the chance to explain it to others" (p.262). However, Prince (2004) suggested that there is some confusion among educators over

what AL actually involves, beyond what is required with traditional methods of teaching the subject of engineering. It is often assumed that learning is already 'active' because of homework assignments and laboratory work.

Generally, the term 'AL' is normally related to any methods which engage students in the learning process (Prince, 2004). In an effective learning environment where AL prevails, greater emphasis is placed on students' exploration of their own meanings, attitudes and values rather than the traditional guidance from the teacher (Bonwell & Eison, 1991). Thus, by placing the students at the centre of the learning process, this approach shifts the focus from teaching to learning and indirectly promotes a learning environment which is better for metacognitive development (Bransford, Brown & Cocking, 2000). While Slavich and Zimbardo (2012) asserted that the heart of AL is the notion that students must read, write, discuss, and engage in problem solving in order to maximize their potential for intellectual growth, McConnell, Steer, and Ownes (2003) also note that AL can foster the growth of thinking skills and promote science literacy. Thus, AL can be derived from two basic assumptions: (1) that learning is by its very nature an active endeavour; and (2) that different people learn in different ways (Meyers & Jones, 1993).

In defining AL more clearly, many writers contrast its approach to that of traditional teaching. The two major learning and teaching approaches within the literature are defined as learner-centred (student-centred) or teacher-centred (Prince, 2004; Skinner, 1938; Sweeney, 1986). Barrows (1996) defined the learner-centred approach as one which makes students responsible for their own learning while the teacher-centred approach emphasizes the role of teachers in providing knowledge for students. However, Slavich and Zimbardo (2012) argued that the name 'student centred-learning' can mean merely that instructors shape the course curriculum and content on the basis of students' needs, abilities, interests and learning styles. Hence, Michael (2006) supported only student-centred instructional strategies which bring in 'active and inquiry-oriented learning', unlike previous teaching approaches.

To date, AL is widely accepted at HE; other institutes show a positive interest particularly when it comes to engineering education. This is because AL implementation has fostered the ability and creativity among engineering students (Spinks, Silburn, & Birchall, 2006; Prince, 2004). With rapid changes in technology and globalization, students need to be equipped with '21<sup>st</sup> Century Skills' which refer to skills required for employability (Selvadurai, Choy & Maros, 2012; Dede, 2010;

Schomburg, 2007). In order to support their education, many studies have revealed that engineering graduates need more than technical knowledge in order to accommodate current employment requirements (Zaharim et al., 2010; Nair, Patil, & Mertova, 2009; Spinks et al., 2006). The interpersonal skills lacking amongst engineering graduates include communication, collaboration and problem solving (Leung & McGrath, 2010). Hence, the idea of 'active learning' has persuaded educators to adopt an AL approach. Because AL is centered on the student, it can encourage deep learning and also improve students' competencies such as critical thinking, problem solving and creativity, communication skills and collaborative skills (Selvadurai et al., 2012; Adams et al., 2011; Nepal & Jenkins, 2011; Rojter, 2009).

### **2.2.2 The Characteristics of Active Learning**

Although there is no generally accepted definition of AL in the education literature, some general characteristics are commonly linked to this approach. According to Bonwell and Eison (1991), students that engage in an AL environment are being encouraged to explore and are responsible for their learning process where it involves higher order thinking rather than just listening and receiving information. Hence, the opportunity to engage in the activity indirectly nurtures their attitude and skills required.

In relation to the application of AL, Felder and Brent (2009) added that students taught with an AL approach will respond to questions, problems or any type of challenge that engages them, either individually or in small groups. Thus, the learning process may involve small project or workgroup activity. In addition, AL allows students to take primary responsibility for their learning path. This encourages them to take ownership of their own learning process. Furthermore, Michael (2006) agreed that the AL approach allows greater interaction in the learning process, not only between students and teachers but also among students.

Since AL has been implemented in many disciplines, including medicine, education, engineering, social science, etc., different terminology has been used to describe essentially the same approach. So far, different methods of AL have been used in the application of engineering education programs, such as Problem-Based Learning, Project-Based Learning, CDIO, Collaborative Learning, Inquiry-Based Learning, Activity Led-Learning (ALL), etc. (Leung & McGrath, 2010; Prince, 2004). In addition, Wilson-Medhurst (2008) acknowledged that AL or ALL for the future

curriculum consists of mixed activities in the learning process. Further brief outlines of each approach are given in section 2.2.5.

### **2.2.3 The Theoretical underpinning of Active Learning**

As learning is defined as a persisting change in human performance or performance potential (Driscoll, 1994), it can be concluded that AL means a type of activity that requires students to participate in the learning process. This corresponds to Dewey's "engagement in learning" (Dewey, 1938). Dewey's term stresses that the learner needs to do something; that learning is not the passive acceptance of knowledge but involves the learner's engaging with the real world. In other words, learning is an active process in which the learner uses sensory input and constructs meaning out of it.

No matter what term is used, the different approaches show more similarities than differences. The main fact is that AL approaches share the same theoretical roots, in that they all build upon a constructivist concept. Constructivist learning is the kind in which knowledge is not passively received but actively constructed by learners as they attempt to make sense of their experiences (Driscoll, 1994). Constructivist learning identifies learning goals by emphasising learning in context. All knowledge is constructed, not transmitted. Knowledge and meaning result from activity and are embedded in activity systems. Normally the construction of the learning process is prompted by problems, questions, issues, and authentic tasks (Felder & Brent, 2009).

As an AL approach is often associated with constructivism, Piaget (1952) and Vygotsky (1978) are common names that influence this philosophy where Piaget's work focuses on cognitive constructivism while Vygotsky is associated with social constructivism. According to Piaget, knowledge acquisition is done from a process of continuous self-construction as compared to Vygotsky who insists that learning is constructed through social interaction and discourse and cannot be isolated from social and cultural context. However, Piaget added that the learning process is nurtured by the individual's experiences. While both of them presented a different persuasion on the theory, they both agreed that learning requires active engagement in order to get a meaningful outcome.

Thus, with regards to the AL approach, Kudryashova et al. (2016) added that the "idea of constructivist learning required four principles of its implementation:-

- a) Learners construct their own meaning
- b) New knowledge builds upon prior knowledge
- c) Learning is enhanced by social interaction
- d) Learning develops through authentic task” (p.461)

Hence, with regards to the current trend in learning approach which favours an AL approach in order to foster critical thinking, Dagar and Yadav (2016) asserted that a constructivist approach is important in order to achieve better academic results as compared to the traditional approach where the learning process involved better innovative activities and enhanced knowledge acquisition.

#### **2.2.4 The Role of staff / educators in Active Learning environment**

In the teacher-centred approach, the major role of the teacher is to transmit knowledge and assess the knowledge of the students. In this approach, the students learn passively in the class. Due to current trends in learning and teaching, the use of AL in higher education has changed the role of the teacher/educator in this modern education environment (Kudryashova et al., 2016). Both students and teacher are now equally required to be actively involved during the learning and teaching process. In an AL approach, the teacher or staff's main responsibility is to empower the learner rather than disseminate the knowledge itself. Hence, the staff is now required to guide the students' throughout the learning process, or in other words, become a facilitator. Hence, the role of the staff/educator is no longer focused on covering the course content but on enhancing the students to enable them to learn effectively (Dagar & Yadav, 2016).

As the adoption of an AL approach encourages active involvement from all the students, effective learning can be accomplished if they work in groups, as study has shown that students learn better when working in groups as compared with when they study alone (Cooperstein & Kocevar, 2004; Keyser, 2000). In other words, this activity indirectly encourages a collaborative learning style (Keyser, 2000). At this point, although the staff still remains in the middle of the students, their role now changes to focus on creating an environment in which students can engage with each other. Hence, the teacher now needs to provide the students with an opportunity to learn independently from their friends or group and just coaches them with some skills in order for them to learn effectively.

Before allowing the learning process to happen in an AL environment, the staff/educator needs to properly plan the students' activity in order to guide the learning journey. Thus, what the staff does greatly affects the students' learning context (Michael, 2006). Hence, the staff's skills to monitor the students is crucial in order to ensure successful participation of the students during the learning process. They should not only be able to nurture students' capability towards knowledge realization, but necessarily encouraging them to participate and contribute during the process. This is in order to make sure the students gather necessary information, grasp the knowledge as well as solve the problems with regards to the learning goal.

Apart from that, staff knowledge is essential in order to ascertain the students' response from the learning process. The necessity to master certain basic knowledge is not only limited to the subject base or designated area but it should cover other knowledge as well. Thus, one of the important requirements that the staff should possess is the capability to become a motivator (Kudryashova et al., 2016). This is required in order to increase the students' motivation to learn as well as to encourage them to possess a positive attitude during the learning process. In addition, the staff are required to help the students to have a better retention of knowledge and develop understanding of the subject taught.

With regards to current changes in technology, the staff capability to master the technology is considered important in order to cope with the change (Deymi, 2016). As the use of IT in learning and teaching is considered a norm among 21<sup>st</sup> century students, the staff should possess a good foundation of knowledge as well as the necessary skills in this area (Radzali, Yusof & Phang, 2013). For instance, the students now prefer to look for information using the internet and other ICT tools as compared to going to the library and look for information in reference books. Thus, it is compulsory for the staff to know how to structure and scaffold the learning in order to make sure the learning objective is achieved. In other words, the staff should be able to monitor and control the extent of learning that should be achieved by the students.

In summary, the role of the teacher or staff in an AL setting is changing now as they are no longer considered as the transmitter of knowledge like before. With rapid change and challenges faced nowadays, current education scenarios require staff to play multiple roles which require them to perform well according to different objectives and the specific learning phase. An important notation by Michael (2006) was that AL doesn't just happen by itself, it requires the teacher in order to make it happen. Thus,

it is critical for the staff to adapt with these changes in order to make AL happen. In addition, the quality of staff will determine how the students work and graduate (Hanapi, Nordin, & Khamis, 2015).

Hence, with regards to AL implementation, Kudryashova et al. (2016) in her related work summarises that ‘the seven teacher’s roles” in AL environment do not only focus as facilitator and trainer in the class, but the teacher also should be able to be a good motivator, controller and moderator during the learning process apart from being a leader and subject expert in order to stimulate the student’s progress during the learning process.

## **2.2.5 Active Learning in Engineering Education**

### **2.2.5.1 Problem-Based Learning**

Problem-Based Learning may be conceptualised as an effective and ideal teaching approach for the 21<sup>st</sup> century (Grigg & Lewis, 2013; Savery, 2006; Ariffin et al., 2004; Yusof et al., 2004). Most researchers agree that Problem-Based Learning is a student-centred approach which focuses on contexts beyond the classroom in order to stimulate a series of skills such as critical thinking, research and collaboration in learning (Grigg & Lewis, 2013; Yusof et al., 2004). Problem-Based Learning was initially used by the Medical School of McMaster University in Canada at the end of the 1960s (Akinoğlu & Tandoğan, 2007; De Graaf & Kolmos, 2003). It was then applied to other disciplines, including law, business studies, dentistry, economics, engineering, and education (Grigg & Lewis, 2013; Akinoğlu & Tandoğan, 2007; Prince & Felder, 2007).

In Problem-Based Learning, the primary goal is to enhance learning by requiring learners to solve problems (Szulevicz & Jensen, 2013; Hung et al., 2008). Thus, the learning process starts when students are given authentic problems instead of direct lectures ( Prince & Felder, 2007; Savery, 2006; Prince, 2004). Ward and Lee (2002) pointed out that by using the central concept of this approach, students will learn the content as effectively as through lectures by attempting to solve realistic problems. In this case, the task of facilitators or instructors is to develop the student’s intrinsic interest in the subject matter, by emphasizing learning as opposed to recall, promoting group work and helping students to become self-directed learners (Hmelo-Silver, 2004). In contrast to the traditional method, the role of teacher or lecturer is to facilitate the learning process rather than to provide knowledge to the student (Savery, 2006).

Moreover, Savin-Baden (2000) defined Problem-Based Learning as organizing the curricular content around problem scenarios rather than subjects or disciplines. He added that this approach is characterized by flexibility and diversity in the sense that it can be implemented in a variety of ways and across different subjects and disciplines in a diverse context. This premise is also accepted by de Graaff and Kolmos (2007), who argued that the solution of the problem can extend beyond traditional subject-related boundaries and methods. Thus, according to Savin-Baden (2000), “this ‘new’ diverse curricula helps students to ‘make sense’ for themselves, where students have been enabled to understand their own situations and frameworks so that they are able to perceive how they learn and how they see themselves as future professionals” (p. 2).

Another important element of the Problem-Based Learning approach is that the learning activity is handled by small groups of students, rather than big groups (Barrows, 1996). The aim of small group learning is to encourage students to adopt a deep learning approach and to be self-directed active learners (de Graaff & Kolmos, 2007). In summary, PBL provides a learning environment which emphasizes higher order thinking skills, multi-disciplinary learning, independent learning, teamwork and communication skills (Hmelo-Silver, 2004). Moreover, Ward and Lee (2002) mentioned that Problem-Based Learning has two distinct goals: to learn a required set of competencies or objectives and to develop problem solving skills that are necessary for lifelong learning (p. 18). Savin-Baden (2000) added that students work in groups or teams to solve or manage situations but they are not expected to acquire a predetermined series of ‘right answers’ (p. 3). A basic comparison of the Problem-Based Learning approach with that of traditional teaching is set out in Table 2.1.

Table 2.1: Characteristics of Traditional Learning and Problem-Based Learning (PBL). Adapted from Barrows (1996) cited in Grigg & Lewis (2013)

	<b>Traditional</b>	<b>PBL</b>
<b>Role of the tutor</b>	Lecturer	Facilitator or guide
<b>Curriculum</b>	Subjects	Problems
<b>Audience disposition</b>	Passive	Active
<b>Organisation</b>	Large classes	Small groups
<b>Approach</b>	Tutor-directed	Self-directed

Many studies report the effectiveness of applying Problem-Based Learning in engineering as a discipline as opposed to traditional methods of teaching. See for example Borgen and Hiebert (2002), de Graaff and Kolmos (2003), Northwood, Northwood, and Northwood (2003), Yusof et al. (2004) and Tandogan and Orhan (2007). Changes have been made to ensure that the approach creates a viable alternative way of producing a competent engineering graduate. The diverse nature of Problem-Based Learning has led to different applications of the approach among institutes and educators. Borgen and Hiebert (2002) added that PBL may be delivered at several levels according to the subject, course, and institution.

De Graaf and Kolmos (2003) compared the Danish model of project-organised learning with a model used in Holland which involves a directed learning process through problem analysis (p. 657). However, Borgen and Hiebert (2002) added that implementation may vary. While other educators struggled to find a suitable approach in Problem-Based Learning, the Republic Polytechnic in Singapore introduced a unique approach entitled 'One day, one problem' which was integrated into the Problem-Based Learning curriculum (O'Grady & Alwis, 2002).

### **2.2.5.2 Project-Based Learning**

Project-Based Learning (PjBL) is another AL approach that provides multiple strategies for learning in the 21<sup>st</sup> century (Musa, Mufti, Latiff, & Amin, 2012; Moreira et al., 2011; Bell, 2010). In PjBL, students acquire knowledge through an inquiry which is the starting point of their learning process (Bell, 2010). Similar to Problem-Based Learning, this approach is student-driven and teachers instigate it by putting a problem or question to a group of students ( Kubiатko & Vaculová, 2011; Bell, 2010). Kubiатko and Vaculová (2011) simplified the definition as the "solution of a problem by groups of

students within a specified time period, leading to the creation of a product (e.g. thesis, report, model etc)” (p.66). PjBL helps a student to work cooperatively and think independently (Chandrasekaran, Stojcevski, Littlefair & Joordens, 2013; Kubiатko & Vaculová, 2011). Shaffner (2003) adds that PjBL is not only a new way of learning, but also an approach to working together. It is an instructional method which promotes deep learning, as opposed to rigid lesson plans which lead to specific learning outcomes. In other words, PjBL requires the student to be actively involved during the learning process (Moreira, Mesquita & Hattum-Janssen, 2011; Kubiатko & Vaculová, 2011). To tackle the problems set in the learning process, students need to create a “concrete” artefact which involves the design of an end product; thus, students must think about all the steps involved, creating their own pathway in the learning process. Prince (2004) adds that the culmination of the project is normally a “written or oral report”, summarizing what was done and the outcome. Another important feature of PjBL is the possibility of using multi-disciplinary knowledge to complete a task (Kubiатko & Vaculová, 2011; Nepal & Jenkins, 2011).

In discussing the application of a PjBL approach, as compared to that of PBL, Prince and Felder (2007) argued that “studies have yielded results similar to those obtained for PBL, including significant positive effects on problem skills, conceptual understanding and attitudes to learning” (p.16). Furthermore, many researchers suggest that the PjBL approach is more suitable for engineering education than PBL (Mills & Treagust, 2003; Morris, 1996). The reason for saying this is given by Mills & Treagust (2003); it is due to the “nature of the engineering profession, which is more familiar with the concept of a project in ... professional practice” (p.13). A different perspective is adopted by Kubiатko and Vaculová (2011), who added that PjBL is “more related to professional reality as the learning process normally takes longer than the time to complete the project given.” The implementation of PjBL is assumed to be “directed to the application of knowledge as compared to PBL which is more centred on the acquisition of knowledge” (Kubiатko & Vaculová, 2011; Hsu & Liu, 2005). Furthermore, PjBL engages students in the authentic exploration of concepts and principles as they learn.

However, Nepal and Jenkins (2011) added that some engineering students dislike PjBL approach, because they need to be very self-directed to complete un-clear and open-ended tasks (p.338). Mills and Treagust (2003) warned that students may gain less in terms of fundamentals than they would from conventionally taught courses. Moreover, he also raises the issue of independent skills, causing students to rely too

much on their team to complete their given project. It should also be remembered that the effectiveness of Project-Based Learning is based on a few factors, namely; prior knowledge and skills, subject selection, individual learning capabilities and time management (Hsu & Liu, 2005). Prince and Felder (2007) added that the challenge of Project-Based Learning is to “define projects with a scope and level of difficulty appropriate to the class and if the end product is a constructed device or if the project involves experimentation, the appropriate equipment and laboratory shop facilities must be available” (p.16).

### **2.2.5.3 Conceive, Design, Implement and Operate (CDIO)**

Originating from Massachusetts Institute of Technology (MIT), the American ‘Conceive, Design, Implement and Operate’ (CDIO) is another AL approach designed specifically for application in the teaching of engineering. It is derived from the statement that ‘engineers engineer’ and runs on the basis of a specific standard syllabus which focuses on engineering fundamentals in the context of ‘Conceive, Design, Implement and Operate’ (Bankel et al., 2003; Crawley, 2001). The aim of CDIO is to define a specific outcome in terms of the learning objectives of the student as well as the necessary skills related to engineering practice (Bankel et al., 2005; Crawley, 2001; Lynch, Seery & Gordon, 2007). This goal provides the basis for designing curricula which are appropriate for various undergraduate engineering programmes. Lynch et al. (2007) added that CDIO supports constructivist theories in teaching and learning and also adopts a problem based learning approach.

The CDIO syllabus was also derived from various inputs from students, faculties, industries, alumni, academia, government bodies, and professional societies.

Berggren et al. (2003) stated that for students, the overall goals of CDIO are to:

- Master a deep working knowledge of technical fundamentals.
- Lead in the creation and operation of new products and systems.
- Understand the importance and strategic value of their future research work.

The CDIO syllabus is constructed as an integrated condensed curriculum which highlights multiple outcomes simultaneously. In Crawley (2001), this syllabus comprises three levels of content with four main expectations, which are:

- i. Technical Knowledge and Reasoning
- ii. Personal and Professional Skills

- iii. Interpersonal Skill
- iv. Conceiving, Designing, Implementing and Operating System in the Enterprise and Society Context.

The CDIO syllabus was first written in 2001; since then it has been revised and updated in order to supply missing requirements (Crawley, Malmqvist, Lucas & Brodeur, 2011).

CDIO takes an integrated learning approach. According to Crawley (2007), “integrated learning means that students learn and practice personal and interpersonal skills as well as product, process and system building skills, while gathering technical and discipline knowledge” (p.134). He went on to say that this method is effective in integrating skills with disciplinary knowledge. It uses AL methods to engage students directly in critical thinking and problem solving activities while using experiential learning to engage students by setting teaching and learning contexts that stimulate engineering roles and practice. In this case, Problem and Project-Based Learning approaches are used as tools to implement the CDIO pedagogy (Kaikkonen & Lahtinen, 2011).

#### **2.2.5.4 Work-Based Learning**

Work-Based Learning (WBL) is defined as learning at work or learning through work (Seagraves & Boyd, 1996) or learning through supervision of a mentor (Johnson, 2001). Boud and Solomon (2001) describe WBL as “class of university program that bring together universities and work organisation to create new learning opportunities in workplaces”. Richard (2013) further defined WBL as a subset of experiential learning. There are various definitions of WBL given by different authors who define WBL as a learning approach which uses the workplace as its medium of learning transfer (Ismail, Mohamad, Omar, Heong, & Kiong, 2015).

Based on WBL philosophy, the students need to be in a real work situation in order to achieve the learning outcome (Sangster, McLaren & Marshall, 2000). Thus, in WBL the learning process occurs through development of meaningful construct by experiencing actual real working life (Rasul & Yasin, 2014). Further to that, Lester and Costley (2010) added that WBL is considered as a different approach which involves transdisciplinary field that sets its own norm and practices, as compared to individual discipline-based learning done at the university. This is due to the fact that WBL

involves a combination of learning in an educational institutional and actual work experience which indirectly enables students to learn a specific competency required in the workplace. In addition to that, Wilson (1997) also added that WBL is an approach that is based on constructivist philosophy where the learning process is still constructed by the student based on their learning experience and the learning is still the product of the students' activities and experiences as explained by Biggs (2011).

The WBL approach has been utilised for more than a decade in countries like the US and UK (Lester & Costley, 2010; Lewis, 2004). For instance, the European Commission (2013) has identified a few types of WBL that are commonly used such as:

- a) Formal apprenticeships where the learner is legally an employee and trainings are given by companies to acquire occupation-related knowledge and also some practical skills. Typically, it involved systematic training and the learner spends significant time on training.
- b) Traineeship, internship, also called work placement, where the learner is legally a student with on-the-job training periods in companies. The learner involvement with the training program is normally less than apprenticeships where the intended learning is to allow the learner to familiarise themselves with the world of work. Hence, the program facilitates their transition from education to employment.
- c) Integrated school-based program where the aim is to teach learners about work rather than teaching them to do work. The program aims to create 'real life' work environments where involvement from industry or corporate to use their facilities are needed.

However, the use of WBL in certain countries including Malaysia is still considered new (Watisin, Ismail, & Hashim, 2015; Rasul & Yasin, 2014). As for the WBL approach, the program is designed in such a way that it can benefit not only the students, but it also benefits the higher institution as well as the work organisation involved. The program may be run in any form of activity that leads to a learning process. Thus, WBL is not an approach which falls under 'paid work' or any program with perceived economic value. The importance of WBL is seen as one of the approaches that would enhance the students' critical thinking as well as bridging the gap that is highlighted by the industries where the students are lacking the required competencies particularly within engineering education. In addition, the involvement of

industry gives a valuable experience as the students are able to benefit from the latest technologies offered by the industry (Boud & Solomon, 2001).

Nevertheless, the implementation of WBL is not as easy as desired due to several challenges encountered by different parties during the implementation process. One of the most important criteria that needs to be properly addressed is to get common understanding and mutual understanding on how the collaboration should be achieved. In general, the WBL pedagogy can be summarised as consisting of four main components as described by Lester and Costley (2010):-

- a) Individual (or group) programs that revolve around the learning contract or agreement
- b) Recognition of previous learning as the starting point of the program
- c) The use of life methodology or an appropriate form of learning, supported by suitable forms of learner support
- d) Valid assessment, which represents relevant academic level and content.

With regards to the WBL approach in engineering education, WBL pedagogy is important where theoretical knowledge can be applied at an actual workplace, ensuring that the students are given the opportunity to think profoundly regarding the actual experience from the industry and observe how the profession complies with the requirement (Nottingham, 2016). In addition to this, Lester and Costley (2010) asserted that WBL approach is being accepted in higher education as a distinct field of practice where the approach is supported by relevant pedagogies and concepts of curriculum in its implementation. Hence the idea of a transdisciplinary field that sits outside of subject frameworks has encouraged the evolution of WBL where it has its own set of norms and practices (Costley & Armsby, 2007).

With a variety of AL adopted within engineering education, Table 2.2 summarises the variety of AL discussed.

Table 2.2: Summary of Comparison on Active Learning Discussed

	<b>PBL</b>	<b>PjBL</b>	<b>CDIO</b>	<b>WBL</b>
<b>Curriculum</b>	Problems as a trigger (often as single subject but can be multi subject)	The project is the unit, or major vehicle for teaching content standards within a unit or multi subject(may involve real world, authentic task and setting)	Standard Syllabus	Integrated course programmes that employ on-the job training (it also known as working under employer supervision with periodic monitoring by teacher)
<b>Approach</b>	Self-directed	Task is open-ended and involves student voice and choice	Project-based and design-build courses	Teaching and learning activity conducted at the workplace
<b>Organisation</b>	Small groups	Done in collaboration within group	Done in collaboration within group	Individual student place at job-site
<b>Student's involvement</b>	Active	Active	Active	Active
<b>Focus</b>	Learning process + assessment	End result evaluation / producing applicable result	Overall development strategy (Conceiving, Designing, Implementing & Operating)	Exposure to work setting, Career planning
<b>Outcome</b>	Problem solving abilities, content acquisition, Learning skill, teamwork, effective communication	Planning skill, teamwork, product development, project management, teamwork	International context benchmarking, Continuous program development	Pre-employment skill, interpersonal skill
<b>Role of the educator</b>	Facilitate small group discussion, provide feedback & guidance as needed	Supervise, facilitate & provide guidance	As Mediator of the learning process	Employer as mentor to supervise the student
<b>Role of the student</b>	Identify learning issue, conduct independent research, join group discussion	Identify learning goal, perform independent research, join group discussion, produce artefact	Identify learning goal, perform independent research, join group discussion ,produce artefact	Involved in teaching and learning activities and adhere to company rules during working hour
<b>Location</b>	Done with teacher guidance, mostly during school Hour	Done with teacher guidance, mostly during school Hour	Done with teacher guidance, mostly during school Hour	Employment setting
<b>Duration</b>	Tend to be shorter (sometime may lengthy)	May be lengthy (weeks or months within specified time)	May be length (weeks or months)	Within specified time (months)

## 2.3 Engineering Education

Education for engineers is generally different in many ways among countries and continents. From early centuries, the formal education of engineers has shown gradual change in order to adapt with technology evolution. These changes are inevitable as it is part of the establishment of engineering education. To date, engineering education has reached an 'appropriate standard' where the education system has reflected the needs associated with what engineers require (Brown, Downey & Diogo, 2009). Apart from competitive curriculum structure, current engineering education is entailed to comply to accreditation policies as well as oblige to the professional body in order to keep to the requirement standards outlined. The next literature briefly explains the establishment of engineering education from global context.

In general, the need for engineering schools started back in the 18<sup>th</sup> century with the inclination towards industrial practice as well as an outcome of the war. The need for education in engineering increased with the industrial revolution that had inspired the establishment of engineering colleges and institutes. For instance, in the UK, only in the second half of the 19<sup>th</sup> century that engineering programs based on science was developed at institutions of higher learning (Bucciarelli, Coyle & McGrath, 2009). Since then, programs for engineering have been properly structured which attracted foreign students to enrol in their engineering courses. The Bologna Declaration in 1999 has influenced several changes in engineering education where the objective is to increase international competitiveness within the European system of higher education. This standardization has enhanced mobility of students as well as the staff creating opportunity for personal growth, employability, enhancing quality of higher education within European countries (Todorescu, 2012). In addition to that, it indirectly attracts overseas students in engineering education. The Declaration has resulted in significant changes made to the new structure of engineering programs.

In recent years, research in engineering education has highlighted concerns on the quality of engineering graduates produced that fail to accommodate 21<sup>st</sup> century requirements. Rapid changes in technology and globalisation nowadays require the workforce not only to excel in the academic but to possess other job competencies for employment. This situation is aligned with UNESCO Report on Engineering (UNESCO, 2010) as well as UK Royal Academy of Engineering report on 'Educating Engineers for the Twenty-first Century' that identified the need to increase the number of competent

engineers entering the industry where the demand is described as being both critical and urgent (King, 2007; Spinks, Silburn, & Birchall, 2006). Apart from that, the increased demand for engineers is not being matched by the number of engineering students enrolled, where the concern is on the number of students entering engineering courses and the progress they made throughout their engineering studies which should be secured without any compromise to the quality, as well as qualifications they eventually receive.

In order to answer the concerns highlighted, it is relatively vital for HEIs to be more effective in their strategies to call for adoption of improvement in their educational approach. This includes a new way of pedagogy adopted in order to train the engineering student to be an effective worker. In other words, the quality of future engineering depends mostly on the quality of engineering education where HEIs inevitably need to define the profile of the modern engineer. Apart from that, it is important to note that it is not HEIs only that should bear the burden, but other relevant bodies are also responsible to identify skills and competencies which the engineering graduates have to possess. Thus, the next section explains in detail how engineering accreditation bodies assist higher education institutes in the UK with regards to setting minimal requirements that engineering courses should comply with in order to produce competent engineering graduates.

### **2.3.1 Engineering Accreditation Bodies and Requirements**

In preparing engineering students to become 'competent engineers', the responsibilities are put on the HEIs in order to equip the students with '21<sup>st</sup> century skills'. In aiding the implementation of these goals, professional engineering associations throughout the world have also made it compulsory for their engineers and engineering graduates to possess the competency and knowledge required for work efficiency. For instance, several studies highlighted important initiatives taken by several engineering bodies across the world in advocating for the engineering profession, code of ethics as well as professional practice (Tittagala, Hadidimoud and Liang, 2016; Byrne et al., 2010). Hence, accreditation is seen as an important factor of improvement of the quality of engineering education around the world. This is due to the fact that in order to be accredited, the engineering program has to meet a number of criteria defined by the accreditation bodies. Table 2.3 below shows several accreditation bodies that provide guidelines for engineering graduates to acquire for several countries namely United States of America (USA), Europe and Australia.

Table 2.3: Engineering Accreditation Bodies Adapted from Hind and Soumia (2017).

<b>Accreditation bodies</b>	<b>Description</b>
ABET	ABET (The Accreditation Board for Engineering and Technology) is an organisation that accredits engineering programs, programs of the applied science, of computer science, and of technology in the United States.
ENAAE	ENAAE (European Network for Engineering Accreditation) is a European association that was founded through the Bologna Process which aims at creating a common European Higher Education Area (EHEA). ENAAE enables accreditation bodies to deliver EUR-ACE label (EURopean- ACcredited Engineer) to the accredited engineering programs.
EA	EA (Engineers Australia) is an Australian accreditation body that ensures the quality of the engineering training through accreditation of the engineering programs.

In relation with accreditation bodies in Table 2.3, the following sub-section provides example information on how the UK develop their engineering education that provides an outline for their engineering courses in order to adhere to the standard and current requirements.

### 2.3.2 Engineering Education: - The UK Provision

In recent years, the number of students who enrol in UK universities has greatly increased, particularly in engineering courses, with 29% of students entering the first degree in engineering and technology being from non-UK origin or international students (Robin, 2017). This situation has shown that the education system in the UK is in demand for tertiary level of education particularly for its engineering courses. As engineering education is one of the high demand courses, it is important to understand how engineering education in the UK uphold its quality as well as the standards in order to meet current demand to produce engineering graduates that comply with current industry requirements and trends (Robin, 2017).

With regards to engineering education in the UK, the UK Engineering Council acts as an 'umbrella body' for the UK engineering institutions (Levy, 2000). The

organisation which is run by engineering professionals bear a major duty which is to set standards of engineering education and training as well as to maintain standard registration requirements for engineers and technicians. Thus, this non-governmental organisation has to ensure that the voice of the engineering profession is heard nationally and to act as a medium for inter-institution activities in order to make sure the UK engineering education fulfils the engineering competence as well as commitment in the field. Hence, the UK Engineering Council has set a specific document 'UK Standard for Professional Engineering Competence (UK-SPEC)' that provides a means to achieve professional competence as professional engineers and technicians (Engineering Council, 2014a).

The Engineering Council document outlines several requirements that require higher education to fulfil the UK Standard for Professional Engineering Competence (UK-SPEC) particularly for engineering education. In order to perceive the quality of the required engineering courses, the establishment of the Quality Assurance Agency for Higher Education (QAA) is to ensure all providers of UK engineering higher education comply to the academic standards through its Subject Benchmark Statement for Engineering (Tittagala et al., 2016). Hence, the accreditation of engineering courses (engineering degree) helps to ensure that the UK engineering education meets the basis for education establishments that helps engineering graduates develop required industry-relevant skills. In order to achieve that, the Engineering Council has established an accreditation handbook in 2004 called 'Accreditation of Higher Education Programmes' (AHEP) in engineering (Engineering Council, 2014b), which is also in-line with the UK Standard for Professional Engineering Competence (UK-SPEC). This handbook has been used widely by engineering education providers as well as individual academic and professional engineering institutions. With regards to the handbook, the Quality Assurance Agency (QAA) has adopted the Engineering Council's learning outcomes as the Subject Benchmark Statement the award of Engineering Council accredited program status. In other words, the engineering courses accredited by QAA shows compliance with overall requirements rooted in UK-SPECS that meet the standards set by the engineering professionals.

With regards to AHEP, the handbook has set out the standard for degree accreditation that emphasises on learning outcomes rather than inputs which have been developed in consultation with the professionals and includes input from employers as stated in the UK-SPEC. In general, the handbook has outlined the required competence that can enable the development of diverse provision, without

losing sight of the required skills, knowledge and understanding that engineering graduates should possess. In general, the accredited engineering and technology programs provides a solid foundation in the principles of engineering relevant to the discipline specialisation. In other words, the different types of accredited engineering programs provide a specific levels of understanding, knowledge and skills for the specific degree awarded. However, there are six key areas of learning that graduates must achieve based on the learning outcome as outlined in the handbook of Accreditation of Higher Education Programmes (Engineering Council, 2014b) that include: -

- Science and mathematics
- Engineering analysis
- Design
- Economic, legal, social, ethical and environmental context
- Engineering practice
- Additional general skills

In addition to that, as the UK Engineering Council is also a full member of the Sydney and Washington Accords, they are also responsible to make sure that their accreditation criteria demonstrate compatibility with other international engineering bodies. For instance, a few alignments have been made in order to reflect to the European Network for Accreditation of Engineering Education's EUR-ACE framework, where the UK Engineering Council was approved as an authorised body to award the EUR-ACE® label to engineering programmes for Chartered Engineer registration. Hence, the UK Engineering Council has outlined and upheld the responsibility to maintain the UK engineering education process as well as to make sure the accreditation requirement is regularly reviewed in order to comply with relevant standards internationally.

## **2.4 Engineering Education in Malaysia**

Initially, Malaysian engineering programs adopted the Australian model with a duration of four years before the engineering students graduated (Aziz, Noor, Ali, & Jaafar, 2005). Several changes have been made since its inception where Malaysian tertiary education is under the jurisdiction of Ministry of Higher Education (MOHE) (Nor, Rajab & Ismail, 2008). The nation's official engineering education model was initiated in 2000 after a study was done by the Malaysian Council of Engineering Dean (MCED)

and Institution of Engineers, Malaysia (IEM) in order to improve Malaysian engineering education (Johari et al., 2002). In general, engineering education in Malaysia is influenced by several main stakeholders namely Ministry of Higher Education (MOHE), Engineering Accreditation Council (EAC) which is controlled by the Board of Engineers, Malaysia (BEM), the Malaysian Council of Engineering Deans (MCED), the Institution of Engineers, Malaysia (IEM) as well as several potential employers (Basiron, Ali, Salim, Hussain, & Haron, 2018).

#### **2.4.1 Pedagogical approach in Malaysian Engineering Education System**

In general, teaching and learning in the Malaysian education system adopts traditional approaches where the learning process depends on the teacher or lecturer. During the process, knowledge is transferred in one-way communication. The traditional delivery system is the same for higher education where the lecturer talks and the students listen while taking notes. In other words, the lecturer is the focal point of instruction where the students passively absorb the information given and apply the knowledge during their exams.

Thus, either for general or engineering education, normal delivery teaching methods have always been content-driven with educators focusing on course objectives; this is also known as teacher-centred learning (Ariffin et al., 2004). In engineering education, the approaches are mainly by lectures supplemented with tutorials (numerical problem solving) and practical (laboratory) classes. This way of learning has been used for a long time with students accepting the knowledge from the tutor without knowing the importance of why they are doing it (Salleh et al., 2007). In addition to that, this system seems to produce engineering graduates who are only capable of answering written exam questions involving memorizing theories but are unable to deal with and work on real problems that are not tested in the exam.

As some studies have been done with regards to teaching and learning, Richmond (2007) asserted that the education system in Asia commonly uses traditional teacher approaches. Thanh (2010) added that in Asian culture, the role of educators is viewed as the definite source of knowledge and it is difficult for them to change the role of knowledge provider. In addition to that, a recent preliminary report in Malaysia Education Blueprint 2013-2025 (Ministry of Education, 2015), where a study done by the Higher Education Leadership Academy (AKEPT) reveals that 50% of educators in Malaysia still adopt traditional methods and only 12% of them perform student-centred-

learning (SCL) in their teaching and learning approach (Radzali et al., 2013). Thus, there is a mismatch recorded particularly related to the university pedagogy where many professors continue to use lecturing as their sole method of teaching and do not keep abreast of the changes of current pedagogy (Basiron et al., 2018).

#### **2.4.2 Changes in Malaysian Engineering Education Teaching and Learning**

In a bid to become an industrialised nation by 2020, rapid change globally has raised concerns among local educators as well as various stakeholders in Malaysian education, leading to a call to reform the education system (Nor et al, 2008). Thus, the engineering education system in Malaysia should be able to produce multi-skilled engineers, professionally competent with soft skills and be able to adapt with the global changes.

The changes in Malaysian engineering education were marked when the Engineering Accreditation Council (EAC), formed by the Board of Engineers, Malaysia, made a compulsory change, with Malaysian engineering education undergoing major improvement in order to become a full signatory member of the Washington Accord (Basri, Man, Badaruzzaman, & Nor, 2004). In order to be accepted permanently by the accord, EAC needed to demonstrate that the engineering faculties in Malaysia are adopting Outcome-Based Education (OBE). The use of OBE is a major concern as the educational reform is compulsory in order to accommodate students with 21<sup>st</sup> century requirements. OBE means focusing on the entire course and it should clearly define the outcome of what the students possess upon graduation (Aziz et al., 2005). The changes for Malaysian engineering education programs was mainly driven by the Malaysian Quality Framework introduced by MOHE in 2004 where the Malaysian Qualification Agency (MQA) holds the responsibility to ensure that an adequate Malaysian Quality Framework (MQF) is in place (Mohammad et al., 2008). Since then, the MQA has made it obligatory to adopt OBE by all academic programs.

Since the EAC started to introduce OBE in 1999, a total of 11 generic attributes have been introduced for engineering graduates. However, the rationale behind the introduction of the attributes was not fully understood by the engineering education providers. Thus, there was a lack of implementation during its initial stage which has led to a necessary revision of its implementation (Aziz et al., 2005). As few changes and little improvement has been made, the final version of the requirements has been finalised in accordance with the MQF requirements. In addition, the accreditation of ISO

9001 exercise has encouraged several engineering schools to embrace the OBE as the organisation requirement to have proper planning, implementation, measurement and improving the process.

### **2.4.3 Malaysian Accreditation & Requirement**

As for Malaysia, results from several studies conducted by local researchers also show similar problems faced by local employers with regards to engineering graduates employment (Mustafa et al., 2008). Feedback from local employers highlight a serious mismatch between the industry requirement and the university's academic philosophy. For instance, a study conducted in 2009 among industry employers highlights the expected competencies of the engineering graduates. A total of 13 competencies namely (a) ability to acquire and apply engineering knowledge, (b) theoretical and research engineering, (c) application and practice oriented engineering, (d) communicate effectively, (e) in-depth technical competence in a specific engineering discipline (f) undertake problem identification, formulation and solution, (g) utilise a systems approach to design and evaluate operational performance, (h) function effectively as an individual and in a group with the capacity to be a leader or manager as well as an effective team member , (i) understanding of the social, cultural, global and environmental responsibilities and ethics of a professional engineer and the need for sustainable development, (j) recognising the need to undertake lifelong learning, and possessing/acquiring the capacity to do so, (k) design and conduct experiments, as well as to analyse and interpret data, (l) knowledge of contemporary issues, and (m) basic entrepreneurial skills (Zaharim et al., 2009).

This situation indirectly informs that its educational outcomes has led to incongruity between its pedagogical stance and the teaching and learning processes. In other words, Malaysia's engineering education programmes do not adequately prepare their graduates to be competent for the current situation. Hence, these gaps require higher education institutions to revamp its educational philosophies where they are required to appropriately address the competency needed for an engineering programme, whereby a re-orientation of the programme is essential.

In answering the dilemma faced by local engineering graduates, The Institution of Engineers Malaysia (IEM) and the Board of Engineers Malaysia (BEM) stress the need for Malaysian engineering graduates to obtain a quality engineering education/programme so that its registered engineers can attain the minimum standard

comparable to global practice. Hence, it is necessary to accredit engineering programmes conducted in every HEI through Engineering Accreditation Council (EAC) where the body is delegated by BEM for accreditation of engineering degrees. The EAC is made up of representatives of the Board of Engineers Malaysia (BEM), The Institution of Engineers, Malaysia (IEM), Malaysian Qualification Agency (MQA) and the Public Services Department (Jabatan Perkhidmatan Awam Malaysia (JPA)).

In 2012, Engineering Accreditation Council (EAC) had outlined 12 outcomes that students of Malaysian institutions of higher learning offering engineering programmes are expected to develop upon completion of their studies. For this purpose, Programme Outcomes are statements that describe what students are expected to know and be able to perform or attain by the time of graduation. These relate to the skills, knowledge, and behaviour that students acquire through the programme.

Table 2.4 below shows the competency that students of an engineering programme are expected to attain:

Table 2.4: Engineering Attributes Outlined by EAC Malaysia (EAC, 2012)

<b>Programme Outcomes</b>	<b>Description</b>
a) Engineering Knowledge	Apply knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation to the solution of complex engineering problems.
b) Problem Analysis	Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
c) Design/Development of Solutions	Design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
d) Investigation	Conduct investigation into complex problems using research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.
e) Modern Tool Usage	Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering activities, with an understanding of the limitations.
f) The Engineer and Society	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues

	and the consequent responsibilities relevant to professional engineering practice.
g) Environment and Sustainability	Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.
h) Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.
i) Communication	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.
j) Individual and Team Work	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
k) Lifelong Learning	Recognise the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.
l) Project Management and Finance	Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

With the competency outlined by the EAC, Malaysia's engineering education cannot rely on the traditional approach whereby the previous exam-oriented system failed to develop graduates with sufficient knowledge and appropriate job competency. The steps taken by the EAC to introduce outcome-based education replacing the traditional approach in Malaysian engineering education has brought a significant shift from teacher oriented to a student-centred learning approach (Yasin et al., 2009). Hence, the introduction of AL within Malaysian HEI's has changed the learning environment where the students are required to be actively involved during the learning process as compared to passively receiving information from their lecturers.

#### **2.4.4 Active Learning Adoption in Malaysian Higher Education**

In Malaysian education, AL was first adopted as long ago as 1979 with the implementation of PBL in the medical field (Servant & Dewar, 2015; Zabidi & Fuad, 2002). However, the use of PBL was scarcely documented until the 1990s, by which time most of the medical schools in Malaysia were employing it (Borhan, 2012; Servant & Dewar, 2015). Since then, the use of AL in Malaysia has been warmly accepted in

other fields, engineering education in particular (Osman, Jamaludin & Mokhtar, 2014; Saad et al., 2014; Borhan, 2012).

The use of Outcome-Based Education in tertiary education has given the green light to Malaysian Higher Education, particularly within engineering education, to adopt changes for its learning and its teaching from the traditional approach (Shaari & Jusoh, 2012). This significant paradigm shift has seen a major change particularly to the curriculum where it focuses on the desired end results of the learning process (Mohammad et al., 2008; Aziz et al., 2005). Hence, the adoption has been focusing on the three major areas in which it is involved, the curriculum development, instructional process as well as assessment method. However, the initial implementation has resulted in some difficulties as the knowledge pertaining to OBE adoption is relatively poor among local education providers (Aziz et al., 2005; Shaari & Jusoh, 2012). However, several universities that have taken a lead to adopt an OBE approach in their engineering faculties, namely University Teknologi Malaysia (UTM) in 2002 (Mohammad et al., 2008), Universiti Kebangsaan Malaysia (UKM) in 2005 (Ismail, Zaharim, Abdullah, Nopiah, & Isa, 2007) as well as Universiti Putra Malaysia (UPM) in 2005 (Aziz et al., 2005), are among major institutions that produce engineering graduates in Malaysia. The implementation has resulted a variety of models in order to adopt OBE requirements.

A few years after the introduction of OBE where the curriculum focuses on competency, engineering education shifted to portray the curriculum based on the capability and knowledge of the students that encourage lifelong learning. In other words, the engineering programs offered should be able to make the students acquire their knowledge through problem solving. Hence, the implementation opens an opportunity to the Malaysian engineering education to explore an AL environment in their teaching and learning process in order for the students to achieve the learning goals and outcomes in a more meaningful way (Osman et al., 2014). This situation consequently led to the introduction of many other AL approaches including PBL, PjBL, and many more that suit their engineering programs.

While the OBE adoption acquired its learning process base from 'problem-based' education, the use of PBL in a Malaysia engineering program was first recorded in 2003 by the Faculty of Chemical and Natural Resources Engineering, Universiti Teknologi Malaysia, for its chemical engineering program (Yusof, Tasir, Harun, & Helmi, 2005). The positive impact received from the teachers as well as the educators has led other institutions to adopt PBL in their engineering courses. Since then, the implementation

of PBL has inspired other local universities namely the University of Malaya (UM) (Said, Adikan, Mekhilef, & Rahim, 2005), Universiti Tun Hussein Onn Malaysia (UTHM) (Salleh, Othman, Esa, Sulaiman, & Othman, 2007) and the Universiti Kebangsaan Malaysia (UKM) (Nopiah, Zainuri, Asshaari, & Othman, 2008) to adopt the PBL approach in their engineering departments.

Not only limited to PBL, the adoption of CDIO, PjBL, POPBL and many other methods that are linked to AL are well received by the Malaysian higher institutes which consequently portray that Malaysian engineering education is taking an effective step in order to produce competent engineering graduates that comply with 21<sup>st</sup> century requirements. For instance, the use of the Project-based Learning (PjBL) approach was recorded by (Kok-Soo, 2003) at Monash University, Malaysia with the aim of inspiring the engineering graduates to engage in AL by providing a simulated scenario of the working life of an engineer. Meanwhile, the School of Engineering at Taylor's University (Malaysia) was the first to initiate CDIO in the country for its engineering program (Al-Atabi, 2012) followed by Universiti Teknologi MARA (UiTM) which had embarked on a CDIO initiative in 2012 (Saad et al., 2014). These new adoptions are said to recognise the mismatch highlighted by the Malaysia Education Blueprint 2015-2025 (Higher Education) where current graduates are reported to lack necessary knowledge, skills and attitude (Ministry of Education, 2015).

## **2.5 Preparedness and Readiness**

### **2.5.1 Defining Preparedness and its Implication**

Preparedness is defined as 'a state of readiness' by the Oxford English dictionary. Readiness as defined by Cambridge English dictionary means willingness or a state of being prepared for something. Readiness, as defined by Lightbown (2013), is a concept which relates to all aspects of learning and development. Armenakis, Harris, and Mossholder (1993) defined individual and organisational readiness for change as involving people's beliefs, attitudes and intentions, according to the extent of the need for change and their perception of individual and organisational capacity to successfully make changes.

Based on the context of this research, staff preparedness implies how the staff get themselves ready for the change. Hence, preparedness in this study is concerned with how they were going to proceed with AL implantation. Thus, the term preparedness

may be translated into a context as a 'state of readiness of a staff for AL implementation'. In this research work, have the staff been prepared with regards to having the required skills, cognitive as well as necessary emotional level to anticipate in AL implementation?

Prochaska et al. (1994) added that if people are not ready for change, they will resist it. The key question for change agents appears to be how people get ready for changes in their environment in a way which enables them to implement such change effectively within their organisation (Walinga, 2008). In the view of Beer (1980), the failure to analyse and deal with readiness issues "can lead to abortive organisation development efforts" (p. 80).

In discussing how to enhance readiness for change, Backer (1995) outlined six different features of readiness:

- a) Readiness can be enhanced
- b) Readiness can be assessed
- c) There are two main types of readiness: Individual and organisational
- d) Readiness is a cognitive characteristic
- e) Readiness is not the same as resistance reduction
- f) Needs assessment is not readiness assessment

### **2.5.2 Individual and Organisation Readiness**

In explaining readiness as a cognitive characteristic, the level of readiness for change is related to what people believe. It may involve people's perceptions of whether they (or their colleagues or organisation) have enough support, a well-defined mission and good leadership structure, a cohesive work team and the skill level required to adopt a particular innovation. Thus, readiness can be seen as part of the overall cycle of innovation and change. In other words, successful changes and innovation may be achieved when staff perceive them to be possible and this perception is well grounded (Backer, 1995).

However, organisational readiness for change is a multi-level, multi-faceted construct. At the organisational level, readiness for change refers to how much organisational members value change and how favourably they appraise three key determinants of their capacity to implement it: the demands of the task, availability of resources and current conditions. When an organisation readiness for change is high,

members of staff are more likely to initiate change, exert greater effort, exhibit greater persistence and display more cooperative behaviour. The result is more effectively implemented.

### **2.5.3 Readiness in education innovation**

In the literature on educational change, Fullan and Hargreaves (1992) pointed out that the study of educational change started in the 1960s, when educational innovation was seen to be the mark of progress. Nevertheless, questions were raised in the 1970s about whether innovation for its own sake was adopted.

Fullan and Hargreaves (1992) suggested that in the implementation of educational change, the focus is on what happens in practice and includes the content and process of contending with new ideas, programmes, activities, structures and policies which are new to the people involved. This demonstrates a basis for action in attempting to understand and influence improvements in practice. Given the difficulties of and resistance to change, Fullan (1982) asserted that successful change has distinct stages, the first of which is “initiation,” defined as making the decision to change and beginning to think about how it will occur. This is followed by participation, pressure and support, changes in behaviour and belief and finally ownership.

Kolmos (2002) took the initiative in an innovation in HE, which changed the traditional approach of Aalborg University to new ways of learning, taking PBL as the method. On the basis of her experiences, Kolmos (2002) stated that “even though development and change in education can occur at many levels, there are fundamentally two basic ones:

- the individual level, which focuses on changing the teachers’ attitudes towards learning and teaching and
- the systemic level, which focuses on changing the overall foundation of the educational programme by instituting new objectives and methods of teaching and evaluation, along with efforts aimed at cultural change” (p.63).

## **2.6 Managing Change in Higher Education**

Changes in higher education are often due to the global changes which must be reflected in the educational approach. As universities are known as major agents of social change, the education in universities is required to become more relevant to

current social changes, in order to capture the movements of the economy (Elton, 1999). Various demands for underlying change and innovation include the adoption of new approaches to learning combined with a diffused approach related to technological development (Angehrn & Maxwell, 2010). For example, the teaching function in the university needs to accommodate the changed trends in lifelong learning.

Preparing an organisation to absorb change is a challenging task. Angehrn and Maxwell (2010) claimed that “changing readiness” is often perceived too narrowly at many levels. Previous writers have stated that 70% of large organisational projects that need to adopt change fail (Burnes, 2005; Harung, Heaton, & Alexander, 1999). In implementing change in HE, Ringel (2000) argued that this process has caused a drastic alteration to traditional boundaries within the university. In support of this, Angehrn and Maxwell (2010) added that ‘higher education institutions have a distinctive culture which makes rapid change even more difficult’ (p.3). However, other writers reported successful attempts, such as the ‘Enterprise in Higher Education Initiative (EHE) in Britain’, which led to significant changes in university curricula and culture (Elton, 1999).

Managing changes in HE involves the participation of the whole organisation, including not only the teaching staff but also members of management, support staff and other kinds of stakeholders (Angehrn & Maxwell, 2010). These diverse disciplines and backgrounds contribute to different beliefs, aspirations and values which make it difficult for the people involved to understand, trust and collaborate with each other (Becher & Trowler, 2001). This limits the steps that the organisation can take to adopt change. The aims cannot be attained merely by organising workshops and one-off announcements by the organisational leader. In fact, changing takes a long time and requires the involvement of everyone in the organisation; ignoring the process of change has been seen as a factor in its failure (Angehrn et al., 2005). To this, Ringel (2000) added that we should dare to challenge some of the organisational principles that have stood for generations in order to be successful and ready for change.

## **2.6.1 The Role and Effect of Management and Organisational culture**

### **2.6.1.1 Changing Policy**

In introducing change where higher education is concerned, Trowler (2002) highlighted that education policy here plays a major role. Policy in this sense is

understood as 'any course of action (or inaction) related to the selection of goals, the definition of values or the allocation of resources' (Codd, 1988). Thus, implementing policy as the first step is important, because it formally sets the implementation process (Becher & Trowler, 2001). Then, implementation should be planned to take account of the way in which the individuals and groups in the hierarchy can shape and nurture the changing process (Reynolds & Saunders, 1987). However, since changing policy in HE vitally involves implementation, Handy (1984) made the valid point that professional organisations that implement the policy must be separated. Thus, organisations such as the Quality Assurance Agency (QAA) are important: they monitor whether the implementation is proceeding according to plan and the terms of the policy.

### **2.6.1.2 Changing the staff**

Adopting changes requires the full co-operation and consent from the groups and individuals involved. Ringel (2000) identified two possible ways for change to proceed: through trust and truth or dissent and conflict. If the changes are accompanied by dissent and conflict, they will, in the end, destroy the organisation. Thus, he insists that they should evolve on the basis of trust and truth, whereby the organisation builds a vision that creates understanding and encourages each member to embrace the innovations.

The previous literature claimed that a major reason for failure to implement changes was neglecting people-related issues and employee satisfaction in the workplace (Skordoulis & Dawson, 2006). Ringel (2000) stressed that poor communication is another contributory factor in the failure to change. This is because information is an important asset in embarking on change. Elton (1999) added that the introduction of any innovation should be on a large scale not only regarding the number of people involved but also the extent of infrastructure supporting management, staff and student development, and the allocation of resources and other services.

Elton (1999) also observed that top management should take a progressive approach in order to make sure that everything is in place. However, the organisation can embark upon a programme of change only insofar as the participants themselves are the actual agents of change (Ringel, 2000). Senge (1999) stated the important qualities in initiating change as follows:

- They are connected with real work goals and processes.
- They are connected with improving performance.
- They involve people who have the power to take action to achieve these goals.
- They seek to balance action and reflection, connecting inquiry and experimentation.
- They afford people an increased amount of “white space”
  - Opportunities to think and reflect without pressure to make decisions.
- They are intended to increase people’s capacity, individually and collectively.
- They focus on learning, in settings that matter (p.4).

Regarding individual resistance to change, Figure 2.1 below shows the Ten Challenges of Change, based on Senge (1999) which centre on individual behaviour patterns in resistance. The ten challenges are classified according to stage, namely, the initiating stage, sustaining transformation and redesigning the organisation.

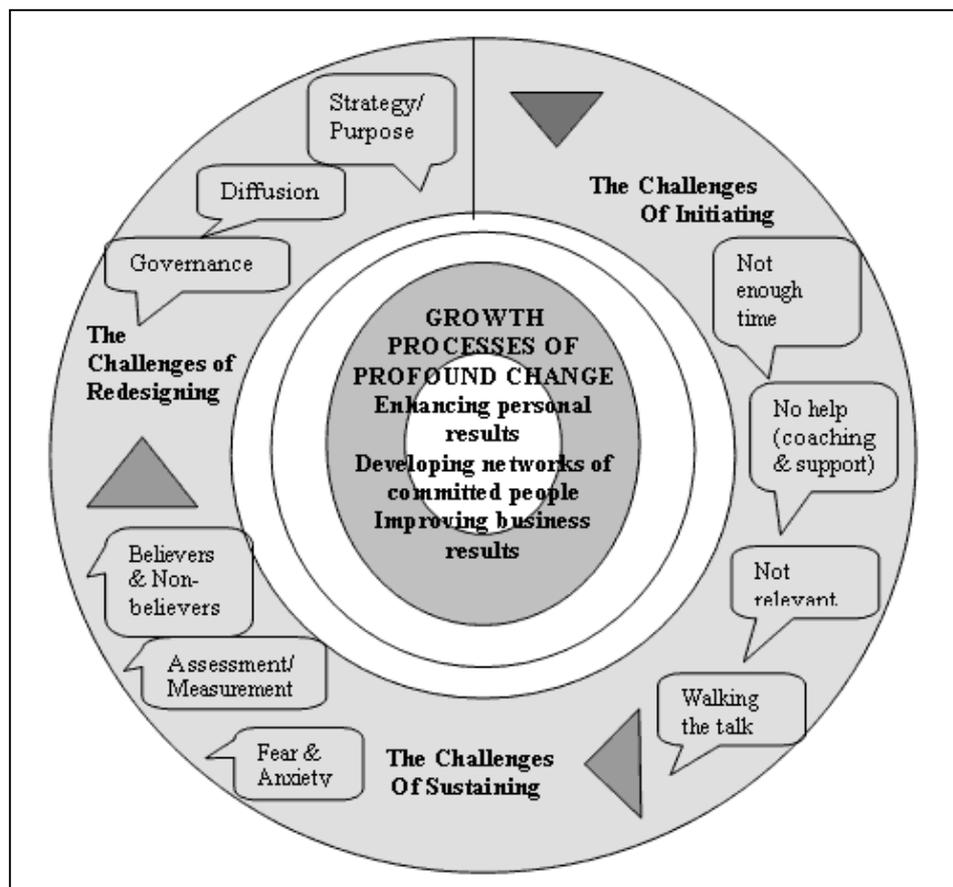


Figure 2.1: The Ten Challenges and Three Growing Stages of Profound Change (adapted from Senge (1999))

As education innovations take root, this process sees an enhancement in staff's professional capacity as both a component and a by-product of educational change, where training and assistance are tailored to needs in continuous cycles of experimentation and reflection. Other forms of support and assistance, such as observation by peers, demonstrations and coaching, together with technical exchanges, can ease the change process. In supporting curriculum change for more sustainable education, Barth and Rieckmann (2012) agreed that transformation largely depends on staff and their willingness to drive the process. Thus, staff development for the academic staff is important for a positive outcome of transformative change.

## **2.7 Staff Perspective**

### **2.7.1 Staff Perspective in AL Implementation**

As the adoption of AL in teaching and learning in HE is a positive approach to produce competent graduates, the changes to encourage an AL approach must start by full understanding on the part of the staff besides students. This is due to the fact that they are the key drivers who play a significant role in its successful implementation (de Oliveira, 2011). Thus, it is vital to understand their experience in AL implementation in order to improve on how they are to work with AL effectively.

With regards to the staff perspective in AL implementation, several studies on the AL implementation highlighted on positive responses from the staff (Servant & Dewar, 2015; Bédard, Bélisle & Viau, 2007; Salleh et al., 2007). As good academic achievement is no longer a guarantee for the students to acquire a job, the implementation of AL activities in the classroom has shown positive changes on the students' observed, particularly in their learning achievements as well as their attitudes and generic skills. Hence, a majority of staff should show their eagerness and temptation to employ the AL particularly for engineering subjects in order to make sure that the students possess the '21st century skills' required for employability.

While AL activities have shown some positive evidence, there are still doubts among the staff to continue implementing the AL approach in their class. This is due to many uncertainties and concerns highlighted by them upon AL implementation particularly within HE. However, as AL implementation has been made 'mandatory' within most engineering institutes, a majority of the staff has shown favourable attitude toward the AL implementation in their learning and teaching process (Lian, 2010). In other words, as most of the staff are in the middle of a cultural change, they have shown

that they are committed and slowly improve themselves to apply AL methods. Hence, this situation has put the staff in a 'dilemma' situation where on one hand, they would like to employ the AL approach in their classroom but on the other hand, they feel that they do not have enough strengths to handle the new changes required (Niemi, 2002).

However, several papers have also recorded some rejection among the staff in AL implementation in their classroom (de Oliveira, 2011; Bouhuijs, 2011; Yusof, Harun, & Abu, 2004). One of the reasons that causes this rejection is due to the staff's reluctance to implement the changes in their teaching technique. This is particularly observed when a majority of the staff are comfortable with a traditional approach such as lecturing (Pundak, Herscovitz, Shacham, & Wisser-Biton, 2009). Yusof et al. (2004) also highlighted that the scenario was normally observed among senior staff as compared to the younger group who are usually still willing to give new methods a try even though they are still sceptical on the AL approach.

### **2.7.2 Staff Experience and Engineering Education**

Preparing engineering graduates who possess competencies and employability skills required by industry is indeed a challenging task. The process should start with the educator or the lecturer themselves where teaching an effective engineering course in the class requires them to have good teaching skills as well as experience in the related field. Previously, typical engineering undergraduates degrees employ independent courses which normally takes 3 to 4 years of study where it was delivered by academic staff who normally do not possess any industrial background (Qi & Cannan, 2007). This situation has indirectly affected the students when they need to work with their lecturer who is trapped in an academic setting whereby the focus is mainly on academic study. Hence, this situation has caused them to have a lack of understanding with regards to the industry requirements.

In supporting the effectiveness of engineering education at higher institutions, there is a demand in hiring educators who have relevant experience from industry. This is due to the fact that one of the best approaches to being an engineer is to learn and experience from the engineers themselves especially those with a long attachment in the industry. Hence, employing academic staff with relevant industrial experience provides an advantage to the education process (Johan, 2015; Hussein & Ahmad, 2009). For instance, their knowledge and skills from previous engineering fields has provided significant insight on the real needs for the students. Hence, their industrial

experience is critical towards preparing the engineering students with the 21<sup>st</sup> century skills required. In other words, these engineering practitioners are able to provide authentic real life problems that can be shared with the students during their learning and teaching process in the class. This is due to the fact that they are able to replicate exactly the real scenario from industry or real life situation which nurtures the students' learning process. This experience could be a drawback to lecturers who do not possess any industrial experience when they join the higher education institute immediately upon graduation. Thus, these lecturers may encounter difficulty in their teaching process to relate authenticity of the problem particularly within an engineering environment.

As traditional methods of teaching in higher institutions merely focus on lecture, the use of AL or activity base in engineering education is well received across the globe. This active approach is relevant to actual scenario in industries where engineers deals with projects and problems. Hence, the use of problem-based and project-based is the best approach to train the engineering graduates to prepare themselves for the real world whereby students should actively engage in problem solving as part of the learning process. Thus, lecturers with industrial experience are expected to bring in more meaningful activities to the students whereby the activity can engage the students in the engineering field. In addition, their experience in industry can be shared as knowledge to the students (Johan, 2015). Another important aspect demanded by industry is to have graduates which possess appropriate skills and values which emphasise on teamwork, good communication skills and lifelong learning. Hence, lecturers who have worked as engineers before are most suited to demonstrate what skills and knowledge is needed by the graduates. Here, sharing their experience and valuable exposure to industry is seen as a successful approach to develop multi-dimensional interpersonal skills required for engineering graduates.

However, introducing an AL approach into engineering education is not an easy task. Despite rejection from the students as well as the staff themselves who enjoyed the traditional way of 'chalk and talk', the acceptance of imposing a different way of learning apart from lecturing has shown promising change within an engineering education scenario. As many studies previously showed that engineering students learn best from a project and problem oriented approach, the new technique is seen to be the best way to engage students in their learning process. Thus, changing the technique of teaching requires the educators to be more prepared and aware on the requirements. Hence, providing sufficient professional development for engineering

educators is vital to make sure the purpose is achieved. For instance, expert educators or professors possessing knowledge in their disciplinary expertise may only possess selected pedagogical knowledge on how to deliver the course content to the students (Fink et al., 2005). Introducing the use of AL in engineering education has helped them to be more effective and to understand the principle of learning in connection with engineering application, which indirectly impacts the teaching activity, and subsequently creates a more powerful way of learning among students. Positive evidence gained from AL activities among the students has attracted educators and lecturers to gradually adopt an AL approach which indirectly convinced them that traditional lecturing is not an appropriate teaching method in preparing engineering graduates that comply with 21<sup>st</sup> century requirements. In other words, an AL approach shows the relevance of implementation in engineering education courses with regards to the competencies that are required from the engineering graduates.

In order to make sure that the staff and educators are aligned with preparing engineering graduates, engineering faculties are required to equip lecturers with effective professional development aligned with the change and that meet the demand of engineering professions. Thus, apart from providing training on the new approach of teaching and learning, the academic staff should be equipped with rapid technological development that may help them in class. In addition to this, engineering educators should develop a strong relationship with the industry as well professional as certification in order to continue their professional development. Hence, collaboration between the two segments is essential if engineering curricula is going to impart a thorough understanding of what industry requires and how educators can enhance their teaching approach in their engineering course.

In answering the importance of industry's response with regards to engineering education, educators who do not have industry knowledge and experience are encouraged to do an attachment with industry in order to overcome the setback that they have. For instance, after having significant industry experience, these situations will allow the educators to fill a niche at their institution that might have been ignored before. Exposure from industrial attachments could also help the educators to be more creative in handling their courses with the students (Yasin et al., 2009). Apart from that, positive input from participating companies will provide much needed career guidance based on their expertise. Thus, this win-win situation has improved engineering education which not only emphasizes on technical context but also encourages professional obligation to the public.

### **2.7.3 Challenges Faced in AL implementation**

As AL implementation involves changes in the education system, the staff perceptions on AL approach were specifically dependent on the participants' experiences during AL implementation in their classroom. Hence, it is important to highlight and understand the staff is doubt and scepticism upon implementation. This is due to the fact that the obstacles should be overcome as many indicators of AL can be seen to give positive impact towards the education system (Niemi, 2002).

The following sub-section highlights common challenges and obstacles faced in implementing AL within engineering education: -

#### **2.7.3.1 Time consuming**

With regards to time, the majority of staff are concerned with the preparation time that they require prior to the AL session. As compared to the traditional approach which only involves 'chalk and talk', the AL approach requires much additional work that needs to be given attention (Niemi, 2002). For instance, in AL implementation, 'problem' or 'project' are normally given to the class as a learning driver for the students to learn. Thus, staff should be able to produce a suitable 'problem' or 'project' which requires appropriate preparation and knowledge based on the 'problem' or 'project' given to the students. In addition to this, they must also have the capability to manage time effectively for the learning session especially when there are too many subject/syllabus to cover (Gillies & Boyle, 2010).

As the AL approach requires the students to find their own information, this new scenario has triggered a major concern among the staff on the time required by the students to complete the task given to them. As most of the staff are raised with a traditional approach, some of them believe that giving a normal lecture is still a practical approach in delivering the knowledge as well as a fast method in dealing with a big crowd of students. Apart from that, lecturing is still a favourable method when the staff needs to finish a certain amount of syllabus particularly within a limited time (Yusof, Roddin, Awang & Ibrahim, 2015).

Yusof et al. (2015) in her findings revealed that some of the staff are also involved in administration jobs which require additional attention for them to handle.

Hence, this scenario has caused tension faced by them as they require some time to handle both academic and non-academic tasks.

### **2.7.3.2 Facilitation Issue**

In an AL learning and teaching scenario, it is understood that the staff's role is no longer as knowledge provider as highlighted in section 2.2.4. Hence, the change in teaching technique has become a major issue raised by them. Some literature also highlighted that educators face difficulties in implementing AL due to the need to change their role to that of a facilitator (Lian, 2010; Hannum & McCombs, 2008; Witfelt, 2000).

De Oliveira (2011) stated that most academicians, not least those in engineering, have been educated in quite traditional ways. Hence, in their teaching, they tend to reproduce their own educational experience. In addition to that, due to the majority of the staff being raised from a traditional approach, they do not have enough of these experiences as they were exposed to spoon-fed education. Thus, it is not surprising when findings from previous literature revealed that some staff end up giving the answer instead of guiding the students to reaching the answer by themselves during the facilitation process.

In an AL approach, staff are required to facilitate or creatively encourage the students in an AL setting. Hence, the students should be actively involved in the learning process with guidance from the facilitator in order to construct their own knowledge (Lian, 2010). Thus, apart from knowledge on the subject required, it is necessary to ensure that the staff are well equipped with different kinds of skill from those needed for traditional approaches (Bouhuijs, 2011). In other words, there are necessary skills such as the facilitating skill required for the staff to perform well during the facilitation process.

### **2.7.3.3 Staff resistance**

As the staff are the key drivers who play a significant role in successful AL implementation, the changes to encourage an AL approach must start by full understanding on the part of their role, if they are to work with AL effectively. De Oliveira (2011) points out one of the challenges: that "curricular frameworks alone are not enough to establish a project-based learning environment, a move that requires

significant attitudinal changes from all the players involved” (p.49). In other words, the staff should fully understand how their attitude will affect their role in AL implementation.

With regards to this issue, few studies also highlighted that reasons such as ‘not confident in using AL approach’ are among common excuses used by staff in rejecting the AL implementation in their class (Servant & Dewar, 2015; Lim & Choy, 2014; Chandrasekaran et al., 2013). Hence, this situation has caused a dilemma among the staff and consequently they feel very unsure about the future as they are not willing to take the risk to employ the AL approach in their classroom. In addition to that, most of them seem to dislike moving away from their comfort zones. Therefore, their personal barriers created by previous traditional teaching experience has indirectly given a negative perception on the AL implementation.

As their beliefs and attitudes need to change upon applying this new approach to teaching and learning, it is vital to encourage staff to enhance their personal competence. Hence, lack of motivation among the staff is considered to be one of the challenges that needs to be overcome in order to make sure that they feel confident on their capability to employ an AL approach (Moreira et al, 2011). Apart from that, continuous motivation is believed to enhance their confidence level, as well as enthusiasm in AL implementation.

#### **2.7.3.4 Insufficient facilities**

With regards to AL implementation, one of the common challenges highlighted is insufficient facilities available for the approach. Majority feedback from the staff expressed that inadequate learning and teaching resources hinder the implementation effectively (Donnelly & Massa, 2015; Pundak & Rozner, 2008; Yeo, 2005). To support that, Yusof (2015) highlighted that sufficient teaching facilities in the classroom play a significant role to ensure the success of every teaching activity. This is due to the fact that staff were required to make sure the facilities were sufficient for the students to use with regards to the activity involved during the learning and teaching process.

In addition to that, as the AL implementation requires the students to have more discussion among group members, the class layout was found to be insufficient on the activity required as the majority of the learning environment was set up for the traditional approach. Pundak and Rozner (2008) also highlighted the challenges faced in AL implementation and has suggested that in the design of the AL classroom layout, the

staff position should be in the middle of the room and surrounded by 'island' tables for the participating students. This new layout is different from the traditional approach where the staff stands in front of the students.

### **2.7.3.5 Inexperienced Students**

One of the important aims in implementing AL approach in the class is to produce graduates with 21<sup>st</sup> century skills as opposed to being passive characters. Hence, the idea of an AL approach in the class is to develop their personal competency as compared to traditional approach. In other words, AL activities require the students to be actively involved throughout the learning process.

However, many reports have revealed that the process was not happening as expected, as the students do not know their role in an AL environment (Ramires, Martins, Cunha & Alves, 2016; Jamaludin & Sahibuddin, 2012; Schomburg, 2007). As the majority of the students also experienced a traditional approach which only involved a one way learning style or passive environment where they just listen to what the teacher says, memorize the information in the subjects taught and re-write in the exam (Ramires et al., 2016). Thus, it is very unlikely to expect the students to perform as per AL requirements. In other words, the student's previously experience does not really help the students when they move to tertiary level (Schomburg, 2007). Apart from that, a lack of background knowledge in the studied subject also hinders the AL approach causing rejection from the students as they are required to find the information by themselves, unlike the traditional approach (Jamaludin & Sahibuddin, 2012).

In an AL classroom, the students are normally allocated into small groups where the group members should be actively involved in discussions during the learning process. Hence, a good relationship between the group members is essential in order to create a constant learning environment. Hence, lacking of interpersonal skills among the students is found to be one of the barriers for them to work as a team in an AL learning setting.

In addition to that, efficient communication among team members is vital in order to make sure the group is moving towards the same direction. Ramires et al. (2016) also highlighted that the spirit of "parasitism" among team members may hinder the AL implementation in the classroom.

## **2.8 Staff Development program**

Sparks and Loucks (1989) defined staff development in education as “those processes that improve the job-related knowledge, skills or attitudes of school employees” where, in particular, “it is intended to improve student learning through enhanced teacher performance” (p.36). Staff development, which emerged in the 1980s, is believed to be a possible key aspect of a school’s development effort.

Barth and Rieckmann (2012) agreed that staff development programmes have made a big impact in terms of their relevance to initiating individual learning processes and also for facilitating social learning. These programmes also confirm the idea that developing the competence of academic staff is essential for the paradigm shift to be sustainable in higher education. Apart from encouraging staff to enhance their personal competence and change their teaching practices, these programmes have also influenced the general organisational development of higher education institutes.

### **2.8.1 Staff Development Programme for AL Implementation**

Many studies have identified staff training as a key issue in the successful implementation of AL (Coffin, 2013; de Graaff, 2013; Bouhuijs, 2011). One of the notable earlier studies about staff training in AL implementation was that of Murray and Savin-Baden (2000). However, in responding to PBL implementation, Murray and Savin-Baden (2000) added that “there have been few studies that have examined the processes and outcomes of staff development and progress, or evaluated either the success of staff training or, indeed, staff perspectives on such training” (p.108). Zou, Zhao, Du, and Du (2010) added that the effectiveness of staff development programmes in general has been insufficiently documented.

In preparing for an AL environment, teachers or staff are the key drivers who play a significant role in successful AL implementation. It is necessary to make sure that they are well equipped with knowledge and skills which differ from those needed for traditional approaches (Bouhuijs, 2011). De Oliveira (2011) stated that most academics, not least those in engineering, have been educated in quite traditional ways. Thus, they tend to reproduce their own educational experience during their teaching process. The personal barriers thus created require proper training for beliefs and attitudes to change and take a new approach to teaching and learning.

In supporting staff development programmes, Zaidi et al. (2010) maintained that training workshops are an important step in the introductory process. In their introduction of PBL to the curriculum in 2008, the two days of training workshops conducted by the Foundation University Medical College (FUMC) significantly altered the faculty's initial negative perceptions of PBL implementation. de Graaff (2013) added that a wide range of PBL workshops and training sessions have been scheduled from orientation to the actual implementation stage in order to support staff.

This change shifts the role of teacher from a presenter of knowledge to a promoter of learning and staff development programmes are crucial parts of their preparation (Bouhuijs, 2011). de Graaff (2013) believed that teachers need to re-define their professional identity, through a process of culture change. Bouhuijs (2011) added that faculty development is an important tool to enable educators to acquire the educational skills to implement PBL. The preparation of the teachers involved is an important task; they need to understand how to work productively and use PBL effectively. In order to understand their basic functions and roles in AL, de Graaff (2013) listed some components of faculty-development training programmes and discussed their relevance with respect to the learning objectives for teachers, the skills required in the teaching staff and the change in thinking required.

As facilitation is an important element in an AL environment, the transition from lecturer to facilitator is seldom easy. One of the important functions of staff development is to impart facilitation skills and encourage teaching staff to acquire new competencies, for example in facilitating group work and writing cases (de Graaff, 2013). The evaluation of this training reveals that workshops can help to improve it and can also stimulate interest amongst faculty to use PBL in the curriculum (Zaidi et al., 2010).

Bouhuijs (2011) in highlighting continuous monitoring and support, found that continuous facilitation is one of the main factors that contributes to the successful implementation of AL. A medical school in Maastricht which implements PBL, has made this teacher training mandatory since 1982. Coffin (2013) recommended the framework of a new PBL staff training programme for a higher education institution which consists of sequential staff training activities.

Changing to an AL environment cannot be completed overnight. It puts responsibilities on teachers and management, as well as the organisation (Bouhuijs, 2011). Coffin (2013) suggests that at least a year is required to prepare academic staff

before PBL implementation can take place. Having well prepared staff to begin with is a good first step.

## **2.9 Chapter Summary**

This chapter began with a relevant review of the literature on AL and explored its theoretical underpinning with regards to the approach as well as built descriptions of the role of staff within an AL environment. A brief introduction of engineering education was reviewed including the information on how engineering education in the UK is being developed as a reference. This was followed by the history of engineering education in Malaysia that led to the introduction of AL adoption within Malaysia tertiary education where deliberate changes are required in order to improve the engineering graduates' competency. The definition of preparedness and readiness have also been described within the literature, together with relevant issues associated in managing education innovation within higher education. The literature continues by looking at the staff perspective on how they experience AL implementation. In addition to that, the importance of staff development programs with regards to AL adoption has been examined in order to balance with the preparation done upon AL adoption. Having reviewed the literature on the AL implementation within engineering education, the research gap has identified no existing primary research that addresses the staff preparedness in AL implementation. In addition, as most of the studies done on the importance of staff development prior to AL implementation, none have focused particularly on how the staff are being prepared in managing the change to adopt an AL approach particularly within Malaysian engineering education. Thus, this literature leads the researcher to further understand how AL implementation is being implemented within the Malaysian education system particularly within engineering education adoption. Hence, the following chapter proceeds with the methodology used in order to further understand the findings from data collected and achieve the purpose of this research work.

## **CHAPTER 3 : RESEARCH METHODOLOGY**

### **3.1 Introduction**

This chapter describes in detail the methodology used in this research. In determining a suitable, correct methodology, the information used to design the research strategy is a key factor in selecting the best instruments or tools.

This chapter starts by re-stating the main research question and sub-questions that guide the study, followed by a discussion of the research philosophy that underlies it. The conceptual framework in which the research operates is described and the research strategy and methodologies adopted are outlined. Subsequent sections describe the research instruments and the sampling approach used before explaining the analysis process involved. Issues on validity and reliability as well as ethical considerations are further outlined before ending with the summary of the actual research journey.

### **3.2 Research Question**

For this research work, the main research question is:

“How prepared are Higher Education staff to adopt an Active Learning (AL) approach in engineering education?”

In order to answer this, six sub-research questions are identified:

1. What are the staff perceptions of Active Learning as an approach in Engineering Education?
2. What are the factors that influence staff preparedness in AL implementation?
3. What mechanisms are in place to support staff who are introducing Active Learning?
4. How can organisational leadership influence staff preparedness in AL implementation?
5. How can the institutional culture influence staff preparedness in AL implementation?
6. What are the challenges faced by staff in implementing Active Learning?

### **3.3 Research philosophy**

Ritchie and Lewis (2003) noted “how researchers carry out their research is one’s research method, depends upon a range of factors including: their beliefs about the nature of the social world and what can be known about it (ontology), the nature of knowledge and how it can be acquired (epistemology), the purpose(s) and goals of the research, the funders of the research, and the position and environment of the researchers themselves” (p.1). In other words, a research philosophy is a belief about the way in which data should be gathered, understood, analysed and used.

Different epistemological and research methodologies reveal the researchers’ varying epistemological views in research (Willig, 2013). According to Silverman (2010), ‘methodology’ refers to a general approach used for research, whereas ‘method’ refers to specific research techniques. Thus, the epistemological position will lead the methodology, while not necessarily determining how the data are collected or the techniques to be used. Hence, it is vital for researchers to understand the assumptions and beliefs that underpin their research (Holloway & Todres, 2003).

#### **3.3.1 Constructive Interpretive Perspective**

Constructivism or social constructivism is a philosophical perspective of people attempting to understand phenomena by observing the world around them (Creswell, 2014). Interpretivism focuses on the way in which the social world and human interaction contribute to the researcher’s own interpretation and understanding of the phenomena being studied (Ritchie & Lewis, 2003). In other words, a researcher with a constructive interpretive philosophy depends on the participants’ view of the research area (Creswell, 2014).

This philosophy contrasts with positivism, which aims at objectivity and absolute truth (Creswell, 2014). Positivist research seeks facts, rejecting the influence of opinion and free of inquiry and observations, as the final arbiters in theoretical disputes. In addition, positivist research attempts to control the variables and present the world as independent and unaffected by the researcher (Ritchie & Lewis, 2003).

Burr (2003), cited by Heslop (2012), stated that “social constructionism holds that individuals are ‘experts’ of their own experiences and individuals, groups and organisations interpret the world in reference to their own interpretations of events.

Their constructions are based upon frames of reference which are chosen to inform their perspectives, such as assumptions, expectations, theories, concepts and language” (p.52).

### **3.3.2 Researcher’s position**

As defined in Chapter 2, AL applications are often related to constructivism, where students are actively involved in the learning process and construct knowledge according to their understanding. As such, students are not merely passive receivers of knowledge (Jones & Brader-Araje, 2002). The roots of constructivism in education are generally attributed to the work of Jean Piaget, who focused on the active role of the individual in learning how to construct knowledge (Piaget, 1972). In an educational context, constructivism can also foster critical thinking during the learning process (Elkind, 2004). In contrast, objectivist philosophies deny that learners construct knowledge in any sense. Objectivists believe that information is present as independent of learners and knowledge is best transmitted from more experienced to less experienced students (Carson, 2005). Thus, an AL approach is more consistent with Constructivist Learning Theory, as described by Hein (1991), who finds that it involves an holistic process of interaction with the environment as well as social interaction. Knowledge with an existing knowledge structure is here constructed on interpretations of previous experience (Applefield, Huber & Moallem, 2001).

In adopting a constructivist approach in a learning and teaching context, Jones and Brader-Araje (2002) noted that “social constructivism and educational constructivism (including learning theories and pedagogy) have had the greatest impact on instruction and curriculum design because they seem to be the most conducive to integration into current educational approaches” (p.2). As the curriculum is changed to suit the requirements of AL, educators must be taught the skills required to communicate with students and convey the content so as to elicit the desired outcome. This recalls the constructivist alignment theory by Biggs (2001) which co-ordinates the key components in the teaching system, such as the curriculum and its intended outcomes, the teaching methods used and the assessment tasks. In this case, the ‘alignment aspect’ refers to what the teacher does, which is to set up a learning environment that supports the learning activities appropriate to achieving the desired learning outcomes. With AL as the fundamental aim of teaching and learning, the learning process can be more interactive with other rich sources of activity that involve group working and is not limited to lecture and tutorial methods alone.

With personal academic and management experience in the engineering field, the researcher's own ontology reflects that of constructivism. Epistemologically, the researcher tends to view the world from an interpretivist standpoint. This perspective is based on experience as an academic in higher education, where the research area is located. In addition, the researcher also believes in a socially constructed world, which each person tries to understand. Since this study is exploratory in nature, it will analyse interactions between individuals in the research field, interpreting the interactions on a basis of cultural and educational personal surroundings and experiences.

Thus, the rationale of using an interpretive philosophy is justified, because the researcher's own ontology reflects that of constructivism. In addition, the researcher also aims to explore the complex and meaningful differences in human behaviour where deep understanding rather than broad generalization are being sought in their natural environment. In order to achieve this objective, the interpretive approach offers an opportunity to see things from the participants' perspective, given that the research asks what the staff's perceptions are with regard to preparedness for AL and how imposing it impacts on staff development programmes. Furthermore, Landeen, Jewiss, Vajoczki and Vine (2013) added that when the goal of the research is to apply the findings to inform practice rather than to generate theory or explore the essence of a phenomenon.

In conclusion, for the purpose of this research study, a positivist epistemology is rejected since it disregards the involvement of the researcher and aims to provide objective knowledge. This approach does not suit the aims of the study, which is to explore the perceptions of staff and their role as educators. Therefore, the researcher's epistemological will be Interpretivism as she believes that an individual gains their knowledge about the world in a very subjective way.

### 3.4 Conceptual Framework

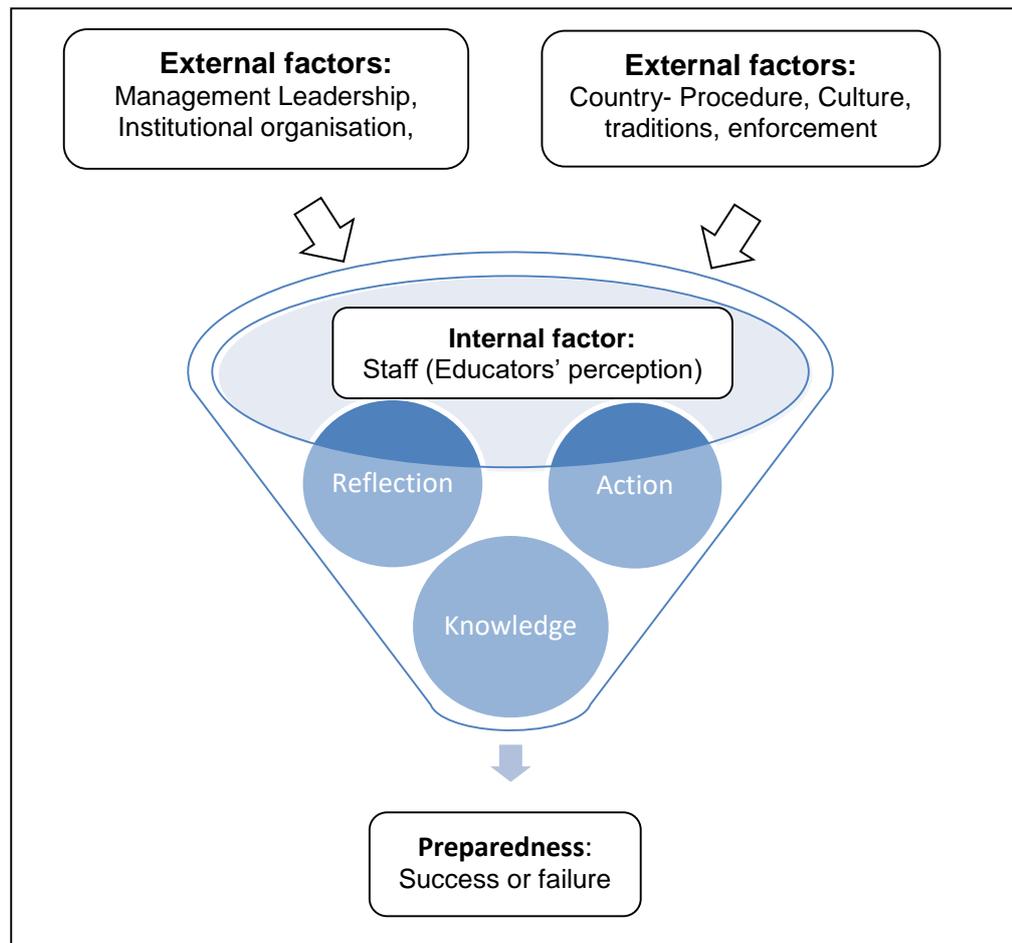


Figure 3.1: Conceptual Framework

This study is bound by a conceptual framework for considering the staff's perspective on being prepared to implement AL as per Figure 3.1. The focus of this study is limited to the aspects that influence AL in HE. The main proposition is that underlying factors in determining the success or failure of implementing AL in HE is dependent on teachers (or academic staff) as individuals (defined as internal factors) and on external factors such as management's leadership and culture. This study posits that the successful implementation of AL depends heavily on individual values and beliefs. In looking at staff perceptions, it takes into account their actions, knowledge and reflections regarding the teaching and learning approach in AL. Therefore, teachers' perceptions play an important part in their preparedness.

Since staff play a major role in the successful implementation of AL, an effective staff development programme is crucial in preparing them. Knowles, Holton and Swanson (2005) introduced the andragogy theory which suits adult learning, in order

to support how and why adults learn to adopt change in their teaching and learning, in particular. However, Mezirow (1997) had already developed a constructivist theory of adult learning called 'Transformation Learning Theory,' which is grounded in human communication. Transformative learning is "a deep, structural shift in basic premises of thought, feelings and actions" (Kitchenham, 2008). In other words, transformative learning is the process of affecting change in a frame of reference formed by the structures of assumptions through which people understand their experience (Mezirow, 1997). Mezirow (1997) adds that frames of reference normally set the 'line of action' which can determine its success or failure.

In looking at staff encounters with AL implementation, an interpretive approach is used to explore the participants' experience. This includes their action, reflection and knowledge during the teaching and learning process of implementing AL. Furthermore, the experience constructed by the participants is related to Mezirow's frames of reference, which are influenced by a set of codes – cultural, social, political, etc. Next, the participant experiences are re-constructed, in order to determine their preparedness for implementing AL. Finally, this study will outline an AL Adoption framework that underlie an optimum situation, not only for the staff, but as a holistic approach for a success AL environment.

### **3.5 Research Method and Design**

Denzin and Lincoln (2000) stated that "a research design describes a flexible set of guidelines that connect theoretical paradigms to strategies of inquiry and methods for collecting empirical material" (p.28). Creswell (2009) added that research design are plans and procedures that lead the research work into detailed methods of data collection and analysis on the study topic. In general, Creswell (2009) summarizes three types of design that are commonly used, namely qualitative, quantitative and mixed methods designs. However, the selection of the research design is commonly based on the research problem or the issue being addressed in the study field. Thus, a proper research design sets up paradigms of interpretation and connects the researcher to suitable methods of collecting and analysing data.

### **3.5.1 Overview of Qualitative research**

In general, qualitative research is distinctively different from quantitative research in terms of using words (qualitative) rather than numbers (quantitative) (Creswell, 2009). Bryman (2004) agrees that qualitative research usually emphasizes words rather than quantification in the collection and analysis of data. In other words, qualitative studies emphasise on process, meaning and understanding, their products and can be richly descriptive (Merriam, 1998).

According to Merriam (1998), qualitative approach is useful for investigating human behaviour and understanding why and how something has happened in the research area. Thus, the qualitative approach allows the researcher to understand and examine what people think, know, conceive or perceive where the focus is to understand process, rather than demonstrating frequencies (Creswell, 2014). In addition, the qualitative approach allows the phenomena of social behaviour in their own natural social setting to be investigated, in a way that a quantitative approach cannot (Ritchie & Lewis, 2003). Moreover, as qualitative research concerns an inductive process, the findings can be used to develop theories and hypothesis for the study.

In this research, a qualitative approach has been chosen during the first phase of data collection with the main purpose of understanding the meaning attributed to individuals' experiences. As the researcher is interested in staff perceptions of preparedness for an AL environment, this approach suits an exploratory process whereby interactions must be understood in an authentic context. Therefore, researchers can from the findings understand not one, but multiple realities. Thus, the experiences of a small number of staff will be examined in interviews to uncover how their preparedness in approach to AL implementation affected the teaching and learning process. To achieve that, data will be collected and mediated through individual persons, as the primary instrument for data collection and analysis.

### **3.5.2 Overview of Quantitative research**

Bryman (2004) defined quantitative research as a research approach that usually emphasise quantification in the collection and analysis of data. Unlike qualitative study which stresses data in a form of expression, Miles and Huberman (1994) asserted that quantitative research stresses the data in the form of numbers.

Denzin and Lincoln (2000) added that quantitative method, highlights the measurement and analysis of the causal relationship between variables, and not the process. In other words, all of them support that quantitative research adhere to scientific philosophy where the variables can be measured by an instrument so that numerical data can be analysed by using statistical procedures.

In doing quantitative research, Bryman (2004) identified sequential steps that quantitative research usually follows theory, hypothesis, research design, devise measures of concepts, select research site, select research subjects, collect data, process data, analyse data, and identify findings. Hence, in doing quantitative research, a researcher should follow a set of procedures in a linear order, starting with a hypothesis. As Robson (2002) asserted that qualitative research are rarely divided into separate steps but are more incorporated and holistic in nature, Punch (1998) agreed that quantitative research is thus considered to be a simpler approach. Thus, Creswell (2009), added that the most common method for collecting data through the quantitative paradigm is by the use of survey.

Hence, for this research, data from the initial exploration, the qualitative findings will be used to develop questionnaires where it is used to collect quantitative data from a larger sample. This is due to the fact that the use of questionnaires can supply huge quantities of data inexpensively and the data can be further analysed statistically to allow for comparisons to be made across groups. Moreover, the quantitative approach is suitable when a researcher needs to generalize outcomes for different groups.

The next section will review the mixed-method approach used for this research work.

### **3.5.3 Mixed-Method Research**

According to Paton (2002) mixed method research provides a few strengths where it is particularly useful in survey, evaluation and field research. This is due to the fact that mixed-method approach provides a broader approach as compared to single approach design where researchers can gather more information related to the study phenomenon (Giddings & Grant, 2006). Gorard (2004) asserted that mixed-method research as a “key element in the improvement of social science, including education research” (p.7) where the research approach strengthens through adoption of multiple methods.

In doing mixed-method research, Bergman (2008) stated that there are two main distinctive ways highlighted from mixed-methods literature. The concurrent design is used with the aim to bring qualitative and quantitative data in parallel while sequential design is used when one type of data is used to build or to extend on the other. Creswell (2007) added that in concurrent design, both forms of data collection are collected at the same time and the results can be integrated from the overall result. In addition to that, the concurrent design offers an offset to any weaknesses within one method with the strength of the other method. With regards to sequential design, Creswell (2007) highlights that this approach is used when the researcher implements the methods in two distinct phases where the first set of data (collecting and analysing) is used before another one is performed. In this sequential design, both combinations are possible; either collecting qualitative first or quantitative data first. Creswell (2007) also added that the sequential approach is useful when the researcher needs initial data set to inform subsequent activity particularly in designing an intervention, selecting participants or to develop instruments.

With multiple combinations that slightly vary within the literature, Creswell (2007) proposed four types of mixed method research namely explanatory, exploratory, transformative or nested design. In general, Rossman and Wilson (1991) asserted that the type of design used will be influenced by reasons such as to enable confirmation or corroboration via triangulation, elaborate or develop analysis, providing richer detail data set and to initiate new lines of thinking through. Thus, decisions need to be made with regards to the priority and the integration of the data. In this case, priority refers to which method is given more emphasis in the research study, either the qualitative or quantitative while integration refers to the phase where the combining or mixing of the quantitative or qualitative data occurs (Creswell, 2007).

Hence, mixed methods is adopted in this research where qualitative and quantitative research are combined in order to allow a better understanding of the problem than quantitative or qualitative approaches alone (Creswell & Plano Clark, 2007). Thus, a quantitative tool is used to explore the qualitative findings in a larger sample. In addition to this, by exploring the data within a larger sample, it is possible to extend further details of the findings as well as to ensure research aims are being well addressed.

### 3.5.4 Exploratory Sequential Design

Based on Figure 3.2 below, the present study adopted exploratory sequential design where the qualitative aspects are given higher emphasis. In addition to this, the first method (qualitative) can help develop or inform the second method used (quantitative). This is shown by using capitalised 'QUAL' to indicate a weight or priority of the study while the lowercase 'quan' shows the less dominant, quantitative source. Hence, by using this approach, the purpose of this strategy is to use quantitative data and results to assist the interpretation of qualitative findings to initially explore a phenomenon (Creswell, 2009). Although the qualitative phase is dominant, the presence of the quantitative phase in this research approach and the use of quantitative data may help the qualitative approach to be well accepted by the quantitative-based audience (Creswell & Plano, 2007). According to Creswell (2009), sequential exploratory design is considered when the researcher requires to develop an instrument. In addition to this, the approach is useful to explore a phenomenon and also to expand on the qualitative findings.

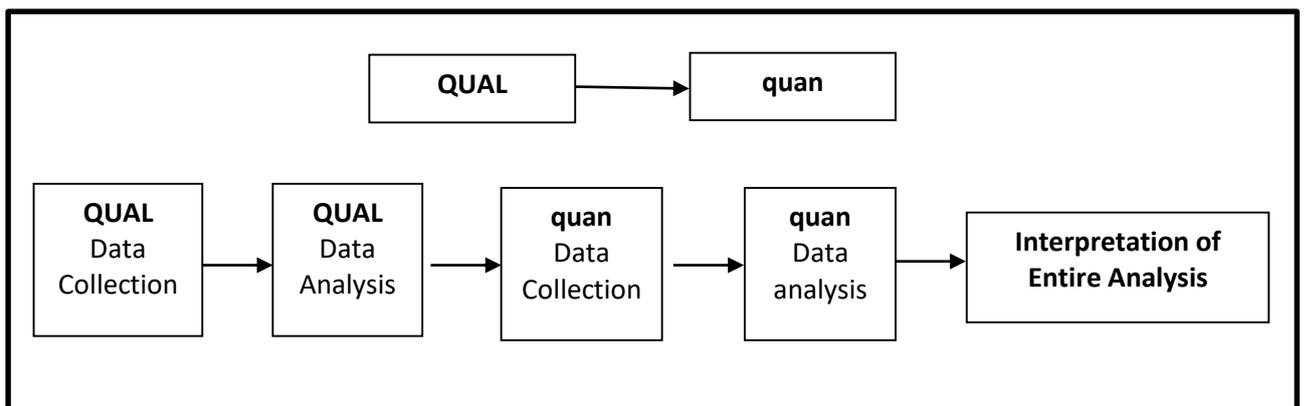


Figure 3.2: Exploratory Sequential Design (adapted From Creswell, 2009).

For this research, the use of an existing theoretical framework (as discussed in chapter 2) is to guide for the first qualitative phase of this study earlier. The qualitative results produced are then used to directly inform the next quantitative phase as described in Figure 3.2. Thus, the two-phase, mixed approach, provides an idea that emerges from the qualitative data to be followed up quantitatively. Hence, this exploratory design implemented for this research could be used at other institutional settings in order to allow detailed understanding to be developed of staff preparedness with regards to AL implementation within Malaysian higher education setting.

### **3.5.5 Exploratory Approach and Triangulation**

In adopting exploratory approach, there are a few reasons why this approach is used in mixed-method design. As with exploratory design, the main intention of adopting a two-phase exploratory is that the result from qualitative method (in-depth interview) can help or develop to inform the second, quantitative approach (survey) (Greene, Caracelli & Graham, 1989). Hence, the exploration is needed in order to find out the variables with regards to staff preparedness in AL implementation as well as related information in building the framework.

In addition to that, the use of exploratory approach allows for triangulation purpose whereby the strategy of using more than one method in order to address the same research question. Thus, this approach looks for a convergence of research findings that enhance credibility. Moreover, as this approach combines the use of qualitative and quantitative methods, it allows triangulation in context. Hence, this research adopted a triangulation approach whereby two main research methods are used:

- A qualitative research method – in-depth interview with staff educators and managements as well as focus group with students
- A quantitative research method- questionnaires in five scales

Hence, the results from this sequential approach are reinforcing each method whereby the use of qualitative findings define the staff preparedness in AL implementation through the staff experience and then confirmed by quantitative evidence that corroborate the suggestion of findings from the qualitative evidence.

### **3.6 Phase One: Qualitative Design**

In this qualitative phase, the researcher has adopted case study design to explore the participants involvement within the chosen institute with the main purpose of understanding the meaning attributed to individuals' experiences with regards to AL implementation. As the researcher is interested in staff perceptions of preparedness for an AL environment, this approach is useful for investigating human behaviour and understanding why and how something has happened in the research area.

### **3.6.1 Case Study**

A case study, as defined by Yin (2009), is “an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clear” (p. 18). Cohen, Manion and Morrison (2011) added that case studies frequently follow the interpretive tradition of research: namely seeing the situation through the eyes of participants and usually employ a variety of data. They are descriptive and detailed, with a narrow focus and allow the combining of subjective (qualitative) and objective (quantitative) data, which is appropriate for the present study. Thus, the use of case study is chosen in order for the researcher to understand and explore actual conditions at the research area. In other words, the use of case studies strive to portray 'what it is like' to be in a particular situation, to catch the close-up conditions and 'thick description' of participants' experiences of thoughts, feelings and situations (Yin, 2009).

In order to archive the objectives of this research, a multiple case study approach will be employed. Yin (2009) argues that the aim to explore certain phenomena and to understand them within a particular context is one of the characteristics of case study research. The multiple case studies arranged for the present research will involve two institutes in Malaysia. In confirming the chosen methodology for the case study, its benefits and challenges are discussed below.

#### **3.6.1.1 Multiple-case Study**

Yin (2014) defines multiple case studies as case studies organized around two or more cases. Multiple case studies are also commonly referred to as collective case studies, cross case studies, multi-case or multisite studies, or comparative studies (Baxter & Jack, 2008; Merriam, 1998). Eisenhardt (1989) suggests that multiple-case studies requires the study of at least four, but no more than ten cases, while Yin (2009) specifies six to ten cases. However, there are no rules about the number of cases required. The most important consideration in conducting multiple case studies is that the result must be sufficient “to provide compelling support for the initial set of propositions” (Yin, 1994).

Multiple case studies have distinct advantages over single case studies (Creswell, 2014; Bryman, 2012; Robson, 2011). Results from multiple case studies may produce comparative results, where data may be similar or contrasting, through an

individual case analysis and also through cross-case analysis ( Yin, 2014; Bryman, 2012; Baxter & Jack, 2008). In addition, Miles and Huberman (1994) argued that “by looking at a range of similar and contrasting cases, we can understand a single-case finding, grounding it by specifying how and where and, if possible, why it carries on as it does” (p.29).

Thus, multiple case studies offer greater variation across cases and provide more compelling interpretations of data (Merriam, 1998). In addition, multiple-case studies can also be used to enhance external validity and increase the precision and stability of the findings (Lockstroem, Schadel, Harrison, Moser, & Malhotra, 2010; Merriam, 1998; Miles & Huberman, 1994). Furthermore, multiple case studies improve theory building in this qualitative research (Yin, 2009). Scarso and Bolisani (2010) add that a multiple approach suits exploratory studies when the complexity of the phenomenon is under examination.

### **3.6.1.2 Multiple-case Study Design**

Figure 3.3 shows how multiple case studies have been used in this research. The first step in designing this case-study had to consist of theory development. The next important step in the design and data collection processes is to develop the necessary research tools and prepare related documentation and protocol for the case study site. Cases are identified on the basis of the phenomenon being studied, the aims and objectives, research questions, availability of data and predetermined criteria in the design and data collection process (Robson, 2002). The tools which will be developed are related to interviews and document analysis.

Before actual data is gathered, a pilot study has been conducted in order to ‘test run’ the tools according to the intended research method (please refer 3.6.8.1). The pilot study has been conducted outside of the actual population study in order to avoid contaminating the samples. This pilot study is to check the validity and reliability of the instruments and also to give the researcher confidence before the actual research began (Blaxter, Hughes & Tight, 2006). Improvements are made to the tools and protocols as necessary after the pilot study. Once this approach was validated, the tools are ready for the actual case study.

In conducting the case studies, the researcher will focus on two institutions in Malaysia. Detailed explanations for choosing these are provided in section 3.6.2.4.

Each case study consists of a 'whole' study, in which convergent evidence is sought regarding the facts and conclusion for the case. Both individual reports and multiple case studies will focus on summary results. When looking across cases, the reports will indicate the extent of the replication logic and why some cases produced contrasting results (Yin, 2014). Then, findings for the individual and the multiple cases will be analysed.

One of the important parts of Figure 3.3 is the dashed-line feedback loop, which represents a situation where an important discovery might occur during the conduct of an individual case-study; for example, where a case might not in fact suit the original design (Yin, 2014). If that happens, redesigning is recommended, either a new choice of cases or new forms of case study protocol. This is done to avoid accusations of being selective in reporting the data and distorting or ignoring the discovery for the purpose of retaining the original theoretical propositions.

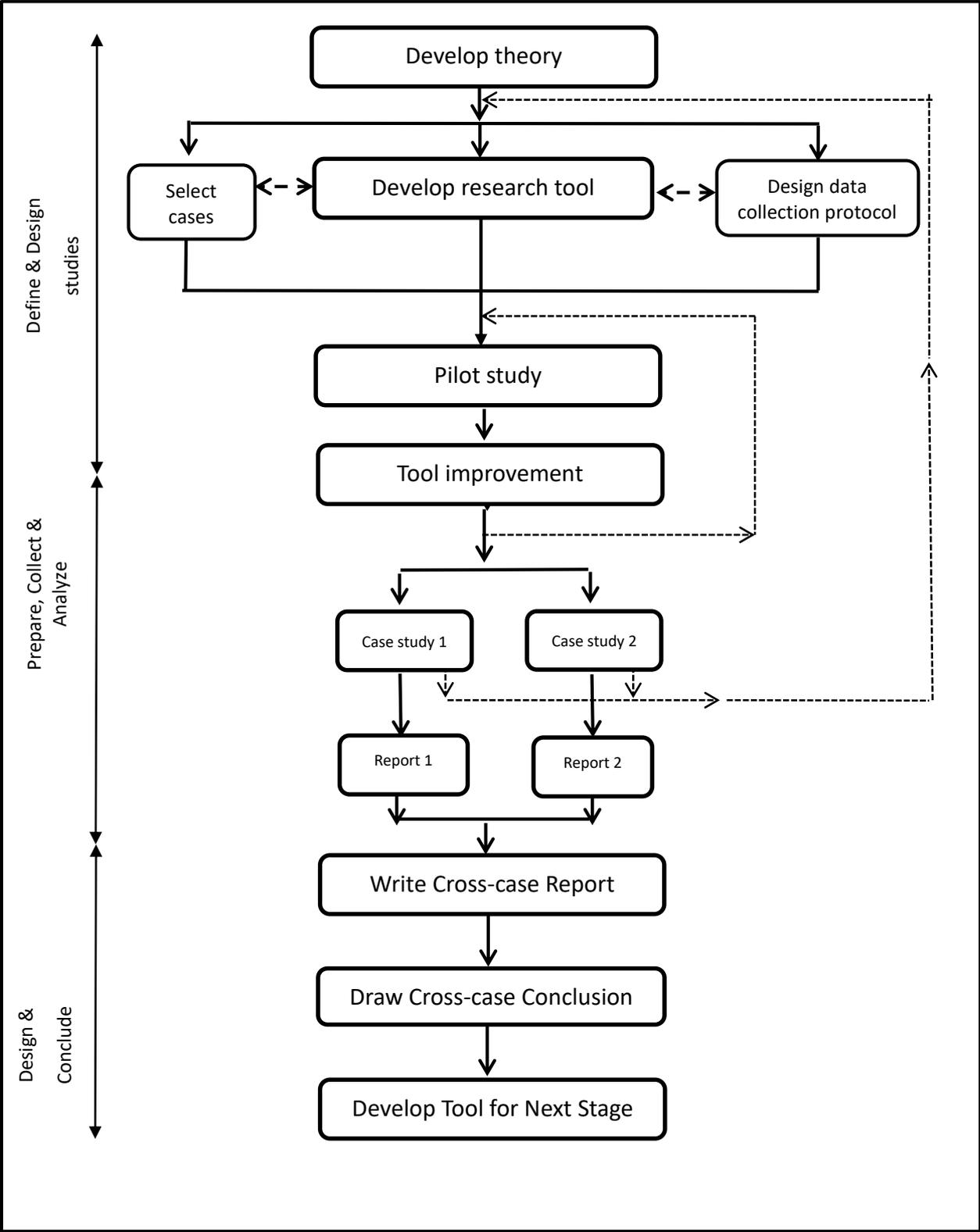


Figure 3.3: Multiple-case study design (Modified and Adapted from Yin, 2014)

### **3.6.1.3 Criticism of the case study approach**

The main issue of case study methodology is that it is often claimed to lack rigorously collected and validated scientific data (Noor, 2008). This may include unsystematic procedures, confusing evidence, or biased judgement (Yin, 2009). This is possibly due to improper data analysis of evidence, from having multiple tools, and affects the validity of the case study.

Darke, Shanks, and Broadbent (1998) suggested that biased judgement in making a case study may reflect why this method is not preferred for research. Bias is mainly due to the “influence by the researcher’s characteristics and background” (p. 278). Yin (2009) also stressed that all researchers using case studies should report and record all evidence fairly and without concentrating on certain points.

It can also be argued that a case study method will take a long time to complete. This is due to the large amount of data to be analysed and also the possibility of unreadable documents (Yin, 2009; Hodkinson & Hodkinson, 2001). This situation may worsen if the study is part of a process of longitudinal research because a great amount of documentation is often produced over time. Hodkinson and Hodkinson (2001) and Darke et al. (1998) argued that time-consuming study will lead to exceeding of the budget, especially in the case of student researchers with limited funds as compared to researchers with sponsored projects.

## **3.6.2 Selection of Sample**

### **3.6.2.1 Participants and sampling procedure**

Merriam (1998) and Robson (2011) state that the two common basic types of sampling are probability and non-probability sampling. Probability sampling takes samples from a whole population, assuming that the result can be generalised, whereas non-probability sampling does not represent the whole population. Probability sampling also involves the random selection of samples. Thus, Bryman (2012) adds that purposive sampling is a form of non-probability sampling, since the researcher does not seek such samples at random. In addition, Robson (2011) adds that a purposive sample normally involves small numbers in order to achieve a particular purpose.

### **3.6.2.2 Purposive sampling**

For this study, the participants will be mainly staff that are involved in AL implementation in an HE setting. This makes the sampling for this study purposive, not random (Miles & Huberman, 1994). Merriam (1998) states that “purposive sampling is based on the assumption that the investigator wants to discover, understand and gain insight and therefore must select a sample from which the most can be learned” (p.61). Thus, the participants will be selectively invited to participate as they are the only participants who could provide the specific information needed. Creswell (2014) agrees that purposive sampling occurs when a researcher, in order to answer the research question, deliberately selects particular informants (or documents or visual materials) to understand a phenomenon. However, Denscombe (1998) argues that a purposive sample is ‘handpicked for the research’ (p 15), since the researcher will already know about the people and will deliberately choose those likely to provide the data required.

Creswell (2014) and Bryman (2012) also mention that qualitative interpretive researchers mainly use purposive sampling methods. This is because they want cases which may provide rich findings, in contrast to the quantitative approach which gathers information from a large, statistical representation in order to generalise the findings. Thus, it is important to select not only sites and individuals but also details about all of them.

In conducting purposive sampling, Miles & Huberman (1994) identify four parameters that should be considered:

1. the setting – where the research take place
2. the actor – who will be interviewed
3. the event - what the actors will be interviewed about
4. the process – the evolving nature of the events undertaken by the actors within the setting

### **3.6.2.3 Case study location / Site selection**

In research, Rubin and Rubin (2012) outlines four main factors that should be considered in choosing the best site for data collection: sites should be

- a) Relevant to the research problem
- b) Easy to access
- c) Allow contrasting and tentative explanations to be tested
- d) Helpful in deciding how far the findings apply elsewhere (p.53).

The first two factors are in fact essential in selecting suitable research sites for this research. However, Yin (2009) proposes two different criteria in selecting sites. The first is that they should be sites where similar results are predicted that can be used in literal replication. The second is that sites may be chosen for ‘theoretical’ replication if contradictory results can be predicted there.

Below are the institutes where the research work was conducted as per Table 3.1.

Table 3.1: Case Study Location

	<b>Institution Name</b>	<b>AL used</b>
Case Study 1	PBL institute	PBL
Case Study 2	WBL Institute	WBL

With regard to this research work, the initial intention is to choose case study sites that use similar AL approaches which allow results for comparison. However, as the number of Malaysian higher education institutes which have adopted the AL approach is limited, the selection of a sample which required the whole institution to focus on AL implementation restrained the sample selection.

From initial information, the majority of AL adoption within engineering education in Malaysia is done based on individual initiative. Hence, the institutes selected for this research study were the most representative available at the time the research study was conducted. Table 3.2 acknowledges the fundamental difference between WBL and PBL approaches used in this study that may affect the difficulty in making direct comparisons between the two types.

Table 3.2: The Fundamental Difference Between WBL and PBL Approach

	PBL	WBL
Role of teacher	Lecturer facilitate during learning process	Engineer or supervisor who also known as mentor supervise the learning process
Working place	In a classroom	Connect classroom into real working place
Learning mode	A 'situation' (problem) is given based on actual scenario	Direct deal with actual scenario
Approach	Activity is done in a small group	Mainly on individual base
Experience	Develop and learn about skill required at work place	Learn and apply skills at workplace
Target	Learn about career	Experience on how actual job is being done

However, the intention of this research is to better understand the process on how to make the staff prepared to manage the change towards AL adoption rather than the AL itself, hence the selection of the sites are acceptable as both institutes are adopting AL approaches that are relevant to their curriculum requirements. In addition to this, the selection of the sites are acceptable as both institutes possess same duration in AL implementation (2010-2014) that are comparable.

### 3.6.2.4 Participant Group & Profile

As the principle of purposeful sampling is to select participants on the basis of the researcher's judgement or interest, a set of criteria has been developed for selecting suitable participants. This is to make sure that the samples selected are ones from which most can be learned. Further detail and characteristics of selected case study are described as below:-

#### 1. Demographic

For this research, participants involved are selected from different characteristics such as gender, ethnicity as well as level of achievement in order to reflect variety of population (Ong, 2007). Meanwhile, selection of students involved participants from different education background where the students are able to express different perception in term of their attitudes towards study, preference as well as

self-regulation that reflect their metacognitive knowledge (Rankin, Silvester, Vallely & Wyatt, 2003)

a) Staff / educator

As for staff / educator, participants are mainly the teacher or a lecturer whom involved directly with the students and with experience in teaching & learning process within the AL environment. This criterion is important as the researcher requires participants to reflect and share their actual experience in implementing AL in their teaching and learning process.

b) Management

At management level, the participants involved should have experience in hiring engineering graduates who studied within the AL environment. In addition, participants should also be involved in at least one Mechanical/Electric/Electronic discipline where they should understand how engineering graduates should be trained in their learning process. The reason of engaging the management level into this research is to identify the support given by them in implementing the required AL at their premises. Hence, it is crucial to investigate their commitment with regard to implementing AL among engineering graduates.

c) Students

As for the students, participants involved should have been experienced in AL teaching & learning process whereby the selection of the participants involved are from different enrolment times. The reason of the study is to understand and analyse how the staff familiarise with the AL implementation based from students' experience over the time.

In conclusion, Table 3.3 below summarise three different stake holders classified according to listed criteria and function. The focus on these particular participants will help the researcher to isolate the data that will eventually guide the research.

Table 3.3: Participants Involved in Case Studies Conducted

<b>Level</b>	<b>Position involved</b>	<b>Criteria / Function</b>
Management	Directors, Senior Management, Dean, Associate Dean, Head of Department / Group	- Dealing with institutional policy - Direct involvement with academic staff but indirectly involved with students
Staff / Educators	Professors, Lecturers, Senior Lecturers, Technical Training Officers, Assistant Lecturers	- Involved directly in teaching and learning with students
Students	All students	- Involved directly in AL implementation as specified by the institute.

2. Type of Institution

With regard to this study, the decision is focused on a fieldwork of Malaysian higher education setting whereby two sites are chosen. Detailed information of the criteria for the chosen institutional backgrounds indicate that both institutes possess similar learning methods that emphasise on hands-on approach. In addition to this, as both institutions are best known as TVET providers, both institutes possess the same level of study, similar educational and managerial policies as well as management approach. Both institutions are HEIs in Malaysia that sit under Ministry of the Rural and Regional Department and Ministry of Higher Education. In addition to this, both institutions are recognised by the Malaysian Qualification Agency (MQA) on the courses that they offer. Another important criteria set is the whole structure of chosen institutions must focus on AL implementation as the researcher is interested to seek real experience on how AL implementation is being imposed to the whole course and not limited to individual adoption.

3. Discipline focused

In this study, the participants are mainly involved in Diploma (PBL Institute) / Advance Diploma (WBL Institute) for Mechanical/Electric/Electronic courses. Although it shows a slight difference of graduates' level, the learning approach in the courses are the main concern for the researcher for this study. Apart from that, the sites are selected based on the availability of the engineering courses offered which is the main interest of this research, and are being taught with an

AL approach to teaching and learning. For instance, based on Appendix 6, the highlighted area in the table shows list of subjects that adopt AL approach. As for WBL Institute, the WBL is employed during third and final semester where the subjects involved require the students to deal with hands-on-activity. A similar situation can be seen in the PBL Institute where PBL is adopted for basic engineering subjects that require students to do practical as well as hands-on. However, for the PBL Institute, the PBL activity is implemented for first and second semester students.

#### 4. Duration of AL Implementation

For this study, both selected institutes started to implement AL approach at about the same time. For the record, the use of AL approach started in 2010, where they have experience of at least 3 years duration since its first day of implementation till the data collection process was conducted (2010-2014). Hence, this study will be able to compare relatively and explore how each institute manages the changes to adopt AL approach and hence understand how prepared are their staff upon AL implementation.

Thus, both institutes provide related information based on selected criteria and the institutes will be called by the pseudonyms given in order to ease the writing as well as to keep the confidentiality throughout the thesis.

### 3.6.3 Sample Size

In research of this kind, the number of people to be selected for interview varies from one case study to another. In order for a qualitative interview study to be published, Bryman (2012) mentions that the minimum number of interviews lies between twenty and thirty, while Patton (1990) suggests between twenty and fifty interviews. In the present study, sample size is determined by the reaching of a 'saturation point' in data collection. This point signals that no new data or findings are being revealed (Guest, Bunce, & Johnson, 2006).

Guest et al. (2006) add that in their study involving sixty in-depth interviews with women in two West African countries, they found out that the transcripts of twelve interviews had already generated 92% of the codes used. Thus, an estimated number of interviews to achieve data saturation point can be predicted from this information. Hence, the ideal numbers of participants in the present research are as per Table 3.4 below:

Table 3.4: Target Number of Participants Per Case Study

<b>Level</b>	<b>Number of participants (for each case study)</b>
Management	Max = 10 participants
Academic Staff	Max = 20 participants
Students	Max = 10 groups (5 participants per group)

For this research, a maximum of sixty participants altogether is the target number of participants for the staff and managements. Since only ten participants at most belong to the management group, saturation point is reached throughout the case studies.

### **3.6.4 Data Collection Method**

Regarding case study design, Yin (2009) argues that data collection is likely to be much more convincing and accurate if the data is derived from several different sources of information. Thus, it is important to select the correct instruments for gathering information and data in order to reach the research findings. For this qualitative phase, the researcher had used interviews, focus groups and documents analysis as data collection methods in order to capture the experiences of staff and participants in each case study. In addition, collecting data from multiple sources will provide a chain of evidence that could be used later for triangulation and validation (Yin, 2003).

#### **3.6.4.1 Semi-structure interview**

In conducting qualitative study, interview is a method commonly employed for education research (Berry, 1999; Dilley, 2004; Merriam, 1998; Rubin & Rubin, 2012). Merriam (1998) defines interview as a “conversation – but a conversation with a purpose”, which is a useful way for researchers to learn about the world of others, although deep understanding may sometimes be elusive (Qu & Dumay, 2011). Somekh and Lewin (2005) added that “an interview is much more than just a tool; [it is] like a drill to go deeper into the discursive structures that frame the worlds of ‘subjects’”. Merriam (1998) also added that the interview method is used when the researcher cannot observe behaviour, feelings or how people interpret the world around them.

As the demand from the research questions requires the researcher to investigate the perceptions, experiences and feelings of the participants about their preparedness for AL implementation, individual face-to-face interview methods are adopted for this study. Thus, individual interviews have been used to explore staff perceptions in detail as well as those of the management, whereby the participants could share their experiences honestly without questioning the confidentiality of the data. Musselwhite, Cuff, McGregor and King (2007) suggest that face-to-face interviews can help the interviewer to clarify the information more successfully, in particular when English is not the first language of the interlocutors or hearing difficulties are involved. In addition, with an in-depth semi-structured questions technique used, open-ended questions were asked in order to give participants freedom of response and to ensure the fluency of the conversation. In addition, Ritchie and Lewis (2003) added that by using in-depth interviews, it offers great advantages for the study, allowing the researcher to understand their personal context among the research phenomena. Hence, the semi-structured interview is used to explore staff perspectives by giving the respondents a chance to express their feelings and opinions freely. Furthermore, the type of question asked has allowed the researcher to respond to the emerging situation, to the worldview of the respondent as it took shape and to his or her new ideas on the topic (Merriam, 1998).

#### **3.6.4.2 Focus Group / Groups interviews**

Another way of doing interviews is by conducting group based interviews, also called focus group interviews (Morgan, 1996). Carson et al. (2001) defines focus groups as a group interview where the topic is clearly defined and it also focuses on something in which it involves interaction between participants. For this study, focus group interview is adopted for the students where the researcher would like to know their experience during teaching and learning process in an AL environment as a way of assessing the staff preparedness in AL adoption. Hence, a group of between two or more students were invited to share about the topic discussed. Richardson and Rabiee (2001) outlined that participants involved in this focus group interview session would normally possess: similar age-range, similar socio- backgrounds as well as being able to have a comfortable conversation with the interviewer as well as each other.

In doing focus groups for the students, one of the main advantages as compared to individual interviews is that the participants will feel less tense with regard to having many participants involved during the session. Hence, this situation may help

the participants to discuss their ideas, opinions, perceptions and thought freely and feel safe to share the information (Krueger & Casey, 2002). Furthermore, this environment may help to reveal important data which indirectly provides the research with important insight. In addition to this, Krueger and Casey (2002) also added that focus groups are economical, fast and effective methods where the interviewer manages to obtain data from multiple participants at a time. However, Butler (1996) pointed out that this method may create a possibility of spontaneous answers among participants with regard to the issue discussed.

### **3.6.5 Data Recording, Storage and Management**

Three possible methods of recording interviews for documentation purposes are by digital audio, video recording or note taking (Rubin & Rubin, 2012). The most common way to record interviews is to use a audio recorder. This practice ensures that everything said is preserved for analysis as well as being more accurate than note taking (Merriam, 1998; Opdenakker, 2006). Using a digital recorder really helped the interviewer to avoid extensive note taking while interviewing, which impedes the flow of the conversation. However, Rubin & Rubin (2012) adds that taking notes 'can help clarify muddled passages' in the transcription (p.64). A good recorder is still required.

Some digital recorders are very effective and can record the times, date and duration of each interview. However, some advance practising is useful to ensure their unobtrusiveness. Maintaining high quality tape-recordings can prevent difficulties later in the research process. Extra batteries and a back-up recorder in case any unforeseen situation prevents one from recording the interview are useful. However, if the interviewers rely too much on recordings, they lose their ability to recall valuable information from the conversation (Rubin & Rubin, 2012).

In using audio recorder to preserve the interview, it is important to remember that the researcher needs to abide by ethical standards. Most institutions' ethics committees require specific consent for any audio-recording from the interviewee. Thus, a form of consent must be signed by the participant before the interview starts.

Once the interview process is complete, the recorded data should be carefully guarded and always kept in a safe place. The audio file should be copied and transferred to a laptop or any secure data store such as an external hard drive or drop-box. If the data is kept on the laptop computer, its accessibility can be controlled by

using a password. Furthermore, a few copies of the audio files should be made in order to prevent the loss of data. In addition, proper labelling is required for future reference. Labels may bear a serial number, for instance, to show the interview sequence or type of respondent (i.e. staff, management or support staff).

Hence, for this study, the researcher has taken all steps as described above in managing the data upon completing the data collection process.

### **3.6.5.1 Transcribing**

Transcribing is a process of typing out as text what was recorded during interviews (Rubin & Rubin, 2012). It is advisable to transcribe the interview record as soon as possible after the interview process, for people tend to forget what was said, making it difficult to complete it later (Merriam, 1998). Furthermore, the immediate examination of recorded data helps to decide what questions to follow up in subsequent interviews (Merriam, 1998; Rubin & Rubin, 2012). However, Robson (2011) adds that it is not necessary to transcribe all such data into text format.

For this research work, the transcribing process was done manually and solely by the researcher. It has to be said that transcribing is a time consuming process. However, the process has helped the researcher as the interviewer to be more familiar with the data. Having finished transcribing an interview, a researcher should ask the participants to review the typescript in order to make sure that it represents what they meant and is an accurate transcription (Rubin & Rubin, 2012). For the sake of safety, a few backup copies of the transcript have been made in order to meet emergencies. Hard copies are kept locked in a cabinet, while files on the computer were password protected. Back-up drives as movable media are used as well as computer clouds such as Drop-box. (Please refer to Appendix 7 for copy of interview transcript sample)

### **3.6.5.2 Translation**

Since this study involves participants where English is not their first language, some of the interviews might have been in a language other than English. Thus, participants who do not share a common mother tongue might raise possible problems in transcribing their data. Rubin & Rubin (2012) emphasize that word-for-word translation often misses cultural concepts and produces different implications. Translation of language should be seen as the exercise of rhetoric and the logical

relationships between the languages should be preserved. Simon (1996) adds that the translation dilemma is not to translate the words alone but to understand the way in which language is tied to local realities. However, as the researcher did the translation by herself, the researcher has taken necessary precaution during the process including being aware of the cultural meanings that the language carries.

To conclude, Figure 3.4, below, shows an overall view of the process of the collection of data from interviews. Data analysis will be discussed in detail in section 3.6.7.

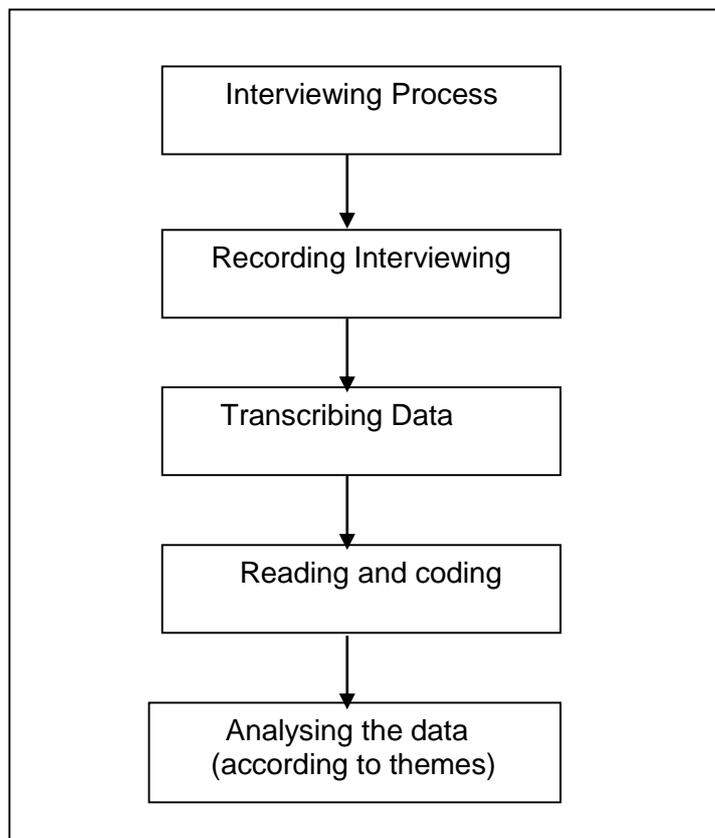


Figure 3.4: Interview data collecting process (Author)

### 3.6.6 Document Analysis

Document analysis involves the study of existing documents in order to either understand their substantive content or to illuminate deeper meanings which may be revealed by their style and coverage. A document analysis may include public documents such as media reports, government papers or publicity materials; procedural documents such as minutes of meetings or financial accounts; or may also include personal documents such as diaries, letters or photographs (Ritchie & Lewis,

2003). In a study involving a school or an educational establishment, the possible documents might include written curricula, course outlines and other course documents, timetables, notices and other communication tools (Robson, 2011).

This method is particularly useful when it relates to the history of an event or experience, in studies where written communications may be central to the enquiry and also when private information is required (Ritchie & Lewis, 2003). Hammersley (1995) added that documentary sources may be needed when situations or events cannot be investigated by direct observation or questioning.

For this research, several documents have been analysed and are as such below:

- 1) Policy Documents / Guidelines, including:
  - i) Internal – Institution policy documents, vision or mission statements related to AL implementation
  - ii) External – Any requirement by a Ministry at national level, Accreditation body, etc.
- 2) Learning & Teaching related documents including those referring to:
  - i) Curriculum – documents concerning curriculum change
  - ii) Lesson Plans – reviewing lesson plans, learning outcomes, course content and lecturers' teaching plans.
- 3) Personal Development documents, including:
  - i) Training records – Any training plan, training records and training needs analysis, in order to validate staff competency in implementing AL. Moreover, a training attendance record may reflect the staff perceptions in AL implementation.
  - ii) Training feedback – To analyse staff perceptions of the training conducted.

In addition, a document analysis method has been used to corroborate the evidence obtained through the interview process.

### **3.6.7 Data Analysis**

In doing qualitative data analysis, the process involves organizing, accounting for and explaining the data. In other words, this process means making sense of the data in terms of the participants' definitions of the situation, noting patterns, themes, categories and regularities (Cohen et al., 2011). Thus, the process starts after all the

interviews were transcribed verbatim. As some of the interviews were done in Malay language, therefore it is necessary for the researcher to translate the interview into English where the analysis can be done easily.

Once the interview data was ready, the data was analysed by using thematic analysis. Braun and Clarke (2006), define thematic analysis as 'a method for identifying, analysing and reporting patterns (themes) within data. This analysis is done in order to uncover the themes that emerge from the data by organizing and describing the rich data in detail. In other words, thematic analysis involves searching across a data set to find repeated patterns of meaning.

Before analysis can be done further, the researcher needs to understand what should be counted as a 'theme'? According to Braun and Clarke (2006), a theme shows something important that relates the data to the research question and also demonstrates some level of patterned response within the data set. In other words, an important theme appears more frequently across the entire data. However, this assumption is not necessarily correct as in qualitative analysis, there is no hard-and-fast answer that reflects the proposition of the data that should be achieved in order to quantify the data as the evidence to be considered as an appropriate theme. Sometimes, a theme might appear relatively little throughout the data set but it captures something important in relation to the overall research question. Hence, the researcher's judgement is important in order to determine what a theme is (Braun & Clarke, 2006).

As the themes emerge during the analysis, it is important to organize the data systematically in order to get meaningful findings. For this purpose, 'Thematic Network Analysis' is used to organize the data and explore the understanding of an issue or the significance of the idea (Attride-Stirling, 2001). Therefore, thematic network analysis builds a web-like structure which essentially organizes the data in order to present the meaning from text into meaningful interpretation.

For this research work, thematic network analysis comprises of a few procedures as outlined by Attride-Stirling (2001) as shown below:-

- a) Basic themes :- lowest order of evidence found from the textual data. It is normally the basis of the data and should read with other basic themes to represent the whole text or context.
- b) Organising themes :- group of basic themes which constitute more

principles of the idea or cluster of similar issues.

- c) Global themes :- super-ordinate themes that summarize the final findings or conclude the text as a whole. In other words, Global theme is the final findings that conclude findings from the data.

Figure 3.5 below illustrates the web-like map that represents the relationship between the three themes;- the *Basic Theme*, *Organising Theme* and *Global Theme*. In developing the network, it starts with the *Basic Themes* and works inwards towards the *Global Theme*. Few collections of *Basic themes* will form an underlying story which becomes *Organizing themes*. These *Organising Themes* which reinterpreted the *Basic Themes* are then brought together which lead to the emergence of the *Global theme*. As the thematic network is designed in a web-like net, the graphic presentation is avoiding any hierarchy implication thus allowing interconnectivity between the themes as well as emphasis on the link between the network (Attride-Stirling, 2001). However, it should be understood that the network shown is only the tool in doing the analysis and not the analysis itself. Hence, once the thematic analysis has been constructed, it facilitates the researcher as well as other readers to understand the interpretation of the data finding.

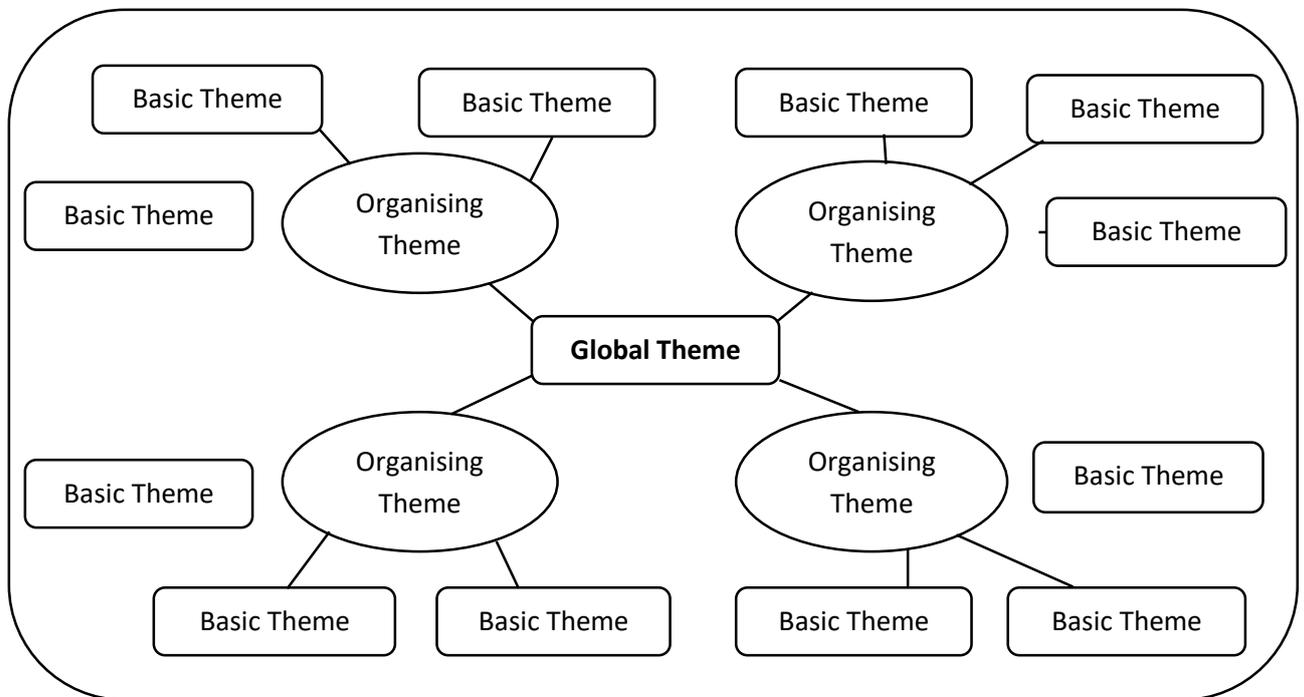


Figure 3.5: Structure of a Thematic Network (derived from Attride-Stirling, 2001)

### 3.6.7.1 Thematic network analysis

For this study, researcher has adopted ‘thematic network’ analysis to qualitative work done. Attride-Stirling (2001) outlined the Thematic Network process which consists of 3 main stages that involve 6 main steps as summarised in Figure 3.6 below. However, these steps are similar with other qualitative analysis that involves thematic analysis. It should be remembered that the steps taken are guidelines to do the analysis and not rules.

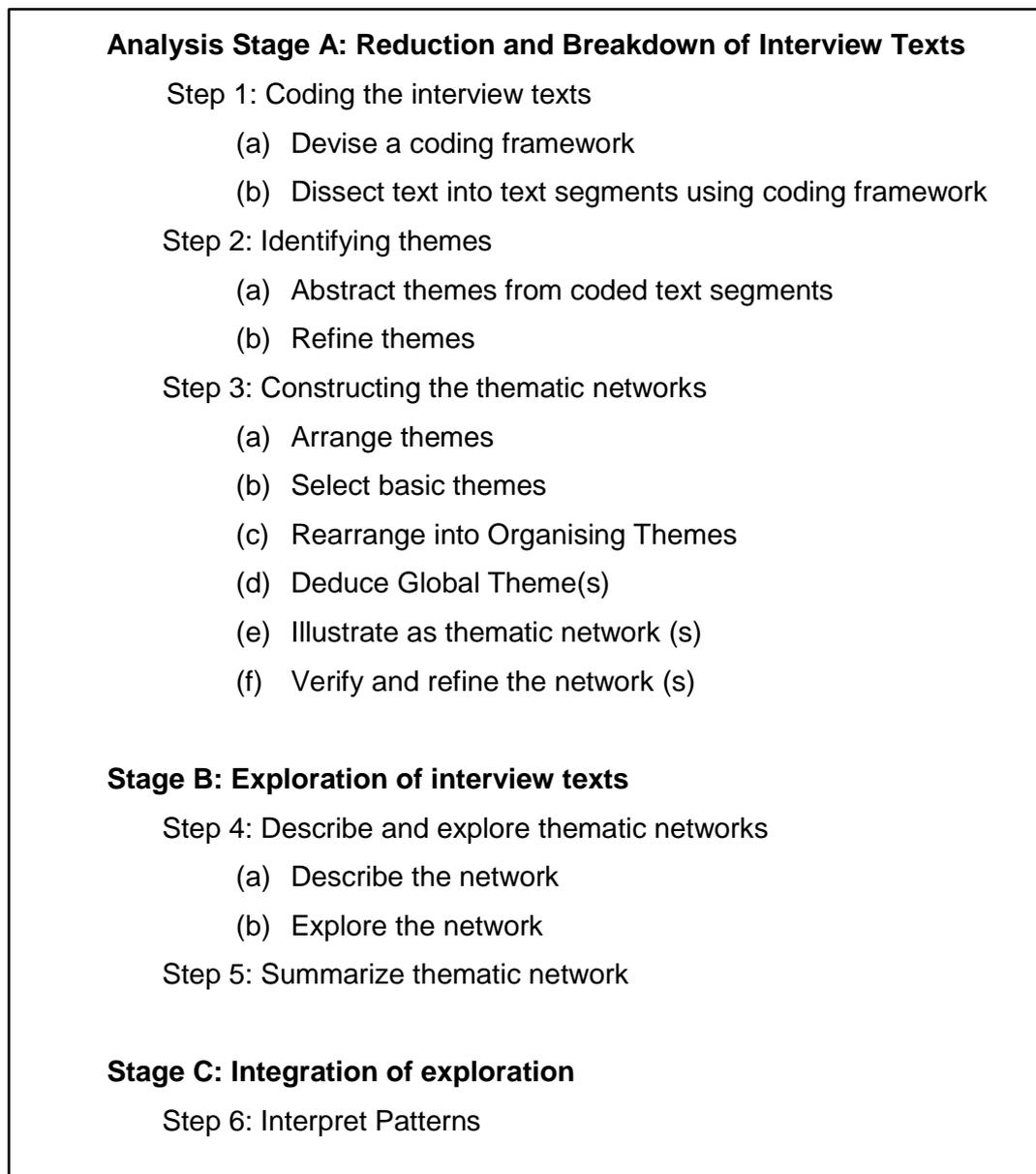


Figure 3.6: Steps in Thematic Analysis Network (derived from Attride-Stirling, 2001)

Based on how 'Thematic Analysis Network' is done as per Figure 3.6, Appendix 8 shows examples of how the codes are refined into themes from the data interview.

With regards to the analysing process, theoretical saturation is reached in analysis when no new relationship, codes or categories are produced for the core categories or their sub-categories. This point is reached even after the addition of new data (Cohen et al., 2011). Ezzy (2002) as cited by Cohen et al. (2011) adds that 'saturation is achieved when the coding that has already been completed adequately supports and fills the emerging theory' (p. 601). Thus, theoretical saturation is achieved when the theory can explain the data fully and satisfactorily (Cohen et al., 2011).

### **3.6.8 Issues of Validity and Reliability**

In conducting a qualitative research study where an interpretive study is involved, the biases, values and judgement of the researcher must be stated explicitly in the research report (Creswell, 2014). Thus, validity and reliability are important in judging a piece of research. Ritchie & Lewis (2003) add that reliability means 'sustainability' and validity means 'being well grounded' in qualitative research; both qualities help to define the strength of the data (p.270).

Somekh and Lewin (2005) define validity as the term used to claim that research results have precisely addressed the research questions. Cohen et al. (2011) describe validity as the state of research when a particular instrument measures what it is supposed to measure, describe or explain (p.179). Allan (2012) refers to validity as success in observing, identifying or measuring what you wanted to do. For qualitative research, Somekh and Lewin (2005) add that validity is ensured by narrowing the field of study to which the outcome can be generalised (p.349).

Reliability is a synonym for consistency and replicability over time, over instruments and over groups of respondents where it is concerned with precision and accuracy (Cohen et al., 2011).

Yin (2009) supplies four tests which are commonly used to establish the quality of empirical social science research, namely, construct validity, external validity, internal validity and reliability. However, internal validity is more related to explanatory and not exploratory study.

Yin (2009) summarises the tests that are relevant to exploratory case studies as described below :

- Construct validity: identifying correct operational measures for the concept being studied.
- External validity: defining the domain to which a study's findings can be generalised.
- Reliability: demonstrating that the operations of a study – such as data collection procedures – can be repeated, with the same results (p. 40).

Cohen et al. (2011) states that construct validity concerns the extent to which a particular measure or instrument for data collection conforms to the theoretical context in which it is located. In a case study, Yin (2014) adds, the use of multiple sources of evidence, establishing a chain of evidence and ensuring that the draft case study report is read by the key informants will increase construct validity. Multiple sources of evidence have been used in this study, including evidence from the interviews, focus group and document analysis. This process will build up the construct validity.

External validity refers to the degree to which the results can be generalised to the wider population, cases, settings, times or situations (Cohen et al., 2011). In the case of qualitative research, Cohen et al. (2011) interpret generalisability as comparability and transferability to a different setting and culture. It is the objective of the present research to generalise outcomes in order to apply them in AL implementation, which would provide a basis for assessing external validity.

In order to maintain validity and reliability, the following steps are taken in this research:

- a) A pilot study has been conducted in order to confirm the variables selected. The pilot study also has been used to determine whether the instrument served the purpose and necessary amendments have been made before the actual data collection.
- b) All participants were asked the same questions from each category during the interview process.

In data collection and analysis, it is important to make sure that the findings and interpretations are accurate. Thus, validating findings is essential; this is where strategies such as triangulation and member checks can be used (Creswell, 2014).

### **3.6.8.1 Pilot Test**

Before conducting the actual interviews, pilot interviews have been carried out in order to 'test run' the tools according to the intended research method. Merriam (1998) highlights that a pilot interview is crucial for trying out interview questions before actual implementation. In supporting pilot testing, Bryman (2004) added that the pilot interview should be designed to determine and to ensure all research instruments function well, hence the pilot protocol shall reflect the challenges of the real research process.

For the pilot study, the researcher conducted three pilot interviews in the UK in order to determine the suitability of the questions used for the audience targeted. The pilot study also has been conducted outside of the actual population study in order to avoid contaminating the samples. As the main participants are educators, 3 lecturers were voluntarily selected for this purpose.

The pilot interviews conducted had given the researcher the opportunity to assess the clarity and appropriateness of the interview questions as well as determine the suitability of the language used to formulate the questions. In addition to this, the pilot session provided some idea on the length of the interview session and indirectly helped the researcher practice interviewing skills. From the interview sessions conducted, the interview process roughly took between 40 to 55 minutes to complete and the process was also recorded by using a digital audio recorder. It was conducted in that manner in order to reflect actual process.

From the pilot interview, participants have responded that they do not have any problems in understanding the questions posed to them as the language used in the interview guide was easy to understand. However, there were some suggestions that there could be a possibility that some participants may not be familiar with certain terms used during the interview. Upon completing the pilot study, the researcher modified the interview questions based on some minor comments from the pilot audience. In addition to this, it helps the researcher to recognize which questions are important for the topic as well as questions that required rewording or are confusing, since the way that questions are worded will affect the type of information produced. Once the corrections were made, the tools are ready for the actual research phase.

Before performing actual interviews in Malaysia, the researcher decided to conduct additional pilot interviews as final preparation at the actual site. The activities

were done in order to add confidence in the interview process as the main structure of the interview protocol has been finalised before that.

### **3.6.8.2 Triangulation**

Triangulation is a process in qualitative research of validating evidence from different types of data, different individuals or methods of data collection in descriptions and themes (Creswell, 2014). Bryman (2012) defines triangulation as the use of more than one method or source of data in the study of a social phenomenon so that findings may be cross-checked (p.717). In other words, triangulation operates within and across research strategies.

Meanwhile Miles and Huberman (1994) identified five types of triangulation that can be used in qualitative research:-

- a) Triangulation by data sources – data collection involved different persons, or at different times, or from different places
- b) Triangulation by method – eg:- interview, observation, documents, etc
- c) Triangulation by theory – using different theories
- d) Triangulation by data type – eg;- combining qualitative and quantitative data
- e) Triangulation by researcher – involve multiple researchers in investigation

In this research, the triangulation process has been carried out in three ways;

- a) Triangulation by data sources – three different stake holders have been identified for data collection namely from the staff, management as well as students.
- b) Triangulation by method- three different methods have been used, interview, focus group and the document analysis in order to validate the findings.
- c) Triangulation by data type – This exploratory approach combining qualitative, quantitative and literature review.

## **3.7 Phase Two - Quantitative Design**

### **3.7.1 The Development of Instrument**

For the quantitative portion in this study, a survey was carried out and the target participants are the engineering staff in Malaysia who are the respondent group. The use of survey is important in order to obtain the information sought for the study in a larger population. Fraenkel and Wallen (2000) added that survey research is one of

the most common methods used in educational research where it is the most suitable tool in order to obtain the information needed. In addition to this, the use of a survey is useful in engaging the opinions of a group of individuals for a certain issue.

In order to develop a suitable instrument to use for the quantitative approach, the data from the qualitative findings is used in this study. Hence, the quotes, statements and codes derived from the earlier qualitative stage are used in the quantitative follow-up stage as stated by Creswell and Plano, 2007. Bryman and Bell (2007) also added that the in-depth knowledge of social context acquired from the qualitative phase can be used to inform the design of survey questions as a self-completion questionnaire.

As for this research, the findings, themes and specific statements obtained from participants during the first phase of data collection are being turned into specific items for a survey instrument that will be used in the second phase. Hence, the data is being transformed in order to explore the initial findings within a larger sample (Creswell, 2007). In addition to this, the quantitative tool is used to extend the detail of the findings in order to ensure the research aims are being well addressed.

### **3.7.1.1 The Questionnaires**

In order to conduct a quantitative study, a set of questionnaires was developed as a data collection instrument. According to Wilson and Mcclean (1994), a questionnaire is used as it provides a structured format that enables information to be obtained. Hence, the themes, codes and statements from the qualitative analysis were considered during the development of the tool. The questionnaires were divided into several sections where specific questions are included for expected participants. The questions in each section were considered to align well with the data gathered during the qualitative phase. Thus, the sections were also considered to provide additional detail which could support the context of the qualitative data. As the purpose of the questionnaire was to answer the research question as well as to triangulate the findings, where it focuses on obtaining the key issues from the qualitative phase of study, it is important that the demographic information of participants is included as it may help with the interpretation of the research.

In order to prepare questionnaires, Hague (1993) stated that there are three types of questionnaires that are normally used; behavioural, attitudinal and

classification. Hence, for this phase, behavioural questionnaires were used to explore practices and approaches while attitudinal questions were used to explore perception. For the survey, the instrument was designed by using categories identified in the qualitative interview data as well as informed by the literature. Hence, the questionnaire was constructed based on staff experience in implementing AL within an engineering environment, pedagogies & curriculum changes in order to achieve education goals, as well as relevance factors related to staff preparedness in AL implementation. While the demographic data including gender, age group, nationality and the programme of study are gathered, the information is not used as essential variables in this study as it is not the aim of this study to explore various participants' perspectives through these various categories, but rather as one concerted voice.

The questionnaire is then presented in a statement format using Likert-type responses that are commonly used in social-research. In this study, the 5-point scale format is used as an 'indication level of agreement' going from strongly disagree to strongly agree (Bryman & Cramer, 2002) where the scale is to determine the staff opinions and attitudes on the questions posed in the questionnaire. In addition to this, as the purpose of conducting the survey was to gauge participants' perceptions, the data obtained from the survey was used for the purpose of understanding and describing the engineering staff's view on the topic discussed. In addition to this, the questionnaires also include open-ended questions that require participants to answer in their own words with regards to their opinion on the respective issues discussed that may help this study.

In the final instruments, there are five categories with a total of 138 questions. Section A consisted of demographic data which was presented with multiple choice answers that consisted of 14 questions related to respondents' background information. Section B consisted of 2 sub-sections that required participants to express their experience with regards to their perception and motivation to adopt AL within Malaysian engineering education at higher institution level. As section C is the core of the survey, it consisted of seven sub-sections which highlight the issues of the present study explored. In order to investigate the staff preparedness in AL implementation, issues include (a) staff understanding with regards to the AL that they employ, (b) staff attitude towards AL implementation, (c) training requirements prior to AL adoption, (d) teaching and learning issues during AL adoption, (e) facilities requirement with regards to AL environment, (f) support from management and (g) support from colleagues in AL implementation are observed. Apart from this, the challenges faced by the staff are

considered in section D. Section E required participants to share their ideas on any suggestions to improve staff preparedness with regards to AL implementation. A copy of the questionnaire can be found in Appendix 9.

### **3.7.2 Selection of Sample Participants**

In conducting this quantitative study, the participants involved consisted of engineering educators in Malaysia. It is important for the researcher to get a correct target population (N) for the survey to be conducted. According to Groves, et al. (2004), “target population” is described as a set of units to be studied. Hence, the researcher has selected engineering educators within Malaysian higher education institutes to participate in the survey as they are the right participants to respond with regards to the research area. The researcher also contacted the Malaysian engineering education Association in order to seek assistance in finding information with regards to the sampling frame where the total of the population of engineering educators in Malaysia is 3450 (N=3450).

### **3.7.3 Sampling size**

For this research, the sample selection was made based on Krejcie and Morgan (1970) (Table 3.5) and Cohen (1992) as per Table 3.6. Based on the total population of engineering educators in Malaysia, N=3450, the number of participants required to be sampled is between 341 and 346, if based on the Krejcie and Morgan (1970) table. However, the Krejcie and Morgan (1970) table does not actually discuss directly the significant level and sampling error compared to the table presented by Cohen (1992). Hence, the level or levels of significance by considering the sampling error of 5% with 95% confidence level by Cohen (1992), is expected to illustrate the results of a more accurate and effective study. Hence, the researcher has decided to collect at least a sample of 346 in order to comply with both sampling size methods considering a sampling error of 5% with 95% confidence level as outlined by Cohen (1992).

Table 3.5: Table of Determination of Total Sample by Krejcie and Morgan (1970)

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	246
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	351
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	181	1200	291	6000	361
45	40	180	118	400	196	1300	297	7000	364
50	44	190	123	420	201	1400	302	8000	367
55	48	200	127	440	205	1500	306	9000	368
60	52	210	132	460	210	1600	310	10000	373
65	56	220	136	480	214	1700	313	15000	375
70	59	230	140	500	217	1800	317	20000	377
75	63	240	144	550	225	1900	320	30000	379
80	66	250	148	600	234	2000	322	40000	380
85	70	260	152	650	242	2200	327	50000	381
90	73	270	155	700	248	2400	331	75000	382
95	76	270	159	750	256	2600	335	100000	384

Table 3.6: Table of Determination of Total Sample by Cohen (1992)



#### **3.7.4 Data Collection Method**

For this quantitative approach, data collection involves a combination of direct, indirect and online methods. The first method of data collection of the survey is conducted by sending an e-mail to potential participants during the pilot exercise. However, due to a poor response rate, the researcher decided to use hardcopy questionnaires to reach out to the target respondents. Based on feedback during the pilot exercise, the researcher opted to use direct face-to-face data collection as well as using the indirect approach where the survey is administered by a third party. While disadvantages of this approach include a long period of waiting, photocopying massive questionnaires/cover letters and huge transportation costs for a large number of people to be visited, this option is still effective and relevant for data collection. However, internet based method questionnaires are also available for participants who requested to do online responses.

#### **3.7.5 Data Analysis**

Upon data collection, the analysis of this quantitative data will use SPSS software version 21. The analysis done includes a reliability test which is conducted to check on the reliability of the data taken. The use of descriptive analysis is used to present the quantitative findings as described in Chapter 7.

#### **3.7.6 Validity and Reliability for Survey Instrument**

In conducting the survey, it is important to make sure that the tools used are well prepared in order to gain meaningful results during the data analysis stage. Thus, it is important to make sure that the reliability and validity of the questionnaires are measured before the actual data is being taken. According to Neuman (2013), validity refers to how well the study 'fits' the actual reality that the researcher is attempting to measure while reliability as defined by Robson (2002) is a measuring device that would produce the same results if it was used on different occasions with the same object of study. In other words, validity is concerned with the study's success at measuring what the researcher set out to measure while reliability is concerned with the accuracy of the actual measuring instrument or procedure (Neuman, 2013). In addition to this, Neuman (2013) added that a measurement has content validity if the instrument has measurement items that cover all the content domain of the variables being measured.

Hence, McDaniel and Gates (1996) suggested that a measurement must satisfy a few criteria that include; -

1. Carefully defining what is to be measured
2. Expert check on the scales used
3. Conducting literature review and interview within the target population
4. The scale has to be pre-tested

For this research, there are a few criteria as suggested by McDaniel and Gates (1996) that were adopted for the purpose of ensuring content validity. Content validity (face validity) was conducted once the survey was developed from the qualitative findings. Content validity refers to the degree that the scale items represent the domain of the concept under study where it involves a systematic assessment (Groves et al., 2004). Hence, an “expert review” was done by two academic quantitative experts, the research questionnaire and scales were reviewed in order to improve the quality of the survey in terms of content coverage as well as the scales used. Moreover, in preparing the set of questions, refinements were made by the researcher and checked by a review done by the supervisory team until the draft was complete.

With regards to reliability, Cronbach’s alpha test was done as a statistical indicator of reliability analysis. Further detail of the analysis is in section 3.7.6.2.

### **3.7.6.1 Pilot study for Quantitative Tool.**

Before embarking on the actual data collection process, a pilot study was first conducted as a platform to test the instrument before it was sent out to the target respondents (Saunders, Lewis & Thornhill, 2012). The rationale for the pilot test was to determine if there were any ambiguities with the questionnaire whereby it can elicit practical feedback. In addition to that, the pilot study may obtain additional information and inform where the researcher can further improve the questionnaire survey before the actual study. Fink, (1995) suggested that the feedback from pilot studies may include clarity of instructions, language construction, framing of questions, time taken by participants to complete the questionnaire and if privacy is sufficiently respected.

For the above reason, a pilot test for this quantitative method was conducted in order to ensure the reliability and acceptability of the research tool. A minimum number of 30 to 50 as a sample size is adequate and reliable in conducting the reliability test

as stated by Sekaran (2006). Hence, a total of 30 respondents who are also engineering educators, participated in the activity.

From the pilot test conducted, there were several issues raised by the pilot study respondents including: (a) clarity of the words used, (b) clarity of instructions posed, (c) length of questionnaire, (d) possibility of repetitive questionnaires. From the feedback received, the questionnaires were modified accordingly. Overall, the total number of questionnaires was reduced from 165 to 138 which may reduce the time taken to complete the survey as well. In addition to this, a quick analysis was done on the data obtained from the pilot study. A detailed analysis is in the next sub-section.

### **3.7.6.2 Cronbach's Alpha Test**

In order to ascertain reliability, the researcher employed Cronbach's Alpha Test to the instrument. This is to make sure the instrument has internal consistency and had actually measured what they were designed to measure (Sekaran & Bougie, 2011). Hence, the test was carried out to determine the consistency of all the responses given by the respondents to all of the items in the instrument. It also examines the interconnectedness of responses using the Cronbach's Alpha ( $\alpha$ ) with a coefficient value ranging from 0 to 1 (Tavakol & Dennick, 2011; Saunders et al., 2012). In other words, Cronbach's Alpha value is commonly used as a statistical indicator of reliability analysis. According to Nunnally and Berstein (1994), Cronbach's Alpha value must be greater than 0.6 or 60% for the instrument to be deemed acceptable while Hair et al., (2010) suggested that the Cronbach's Alpha value must be higher than 0.7. Hence, the cut-off point for the Cronbach's Alpha value for this pilot study is a coefficient alpha of above 0.7 as recommended by Hair et al., (2010). Table 3.7 shows the Cronbach's Alpha value collected from 30 respondents.

Table 3.7: Reliability Coefficient for Variable

Item/ Dimension	Cronbach's Alpha
a) Staff perception on AL	0.857
b) Motivation on AL	0.743
c) Understanding on AL	0.914
d) Attitude on AL	0.936
e) training on AL	0.842
f) Teaching & planning on AL	0.941
g) Facilities on AL	0.937
h) Management support on AL	0.963
i) peer support on AL	0.940
j) Challenges on AL	0.897

### 3.8 Ethical issues

In conducting case studies in a different country, a number of issues must be considered. Ethics refers to right or wrong, good and bad, not only in procedural matters but also in relation to the research purposes, contents, methods, reporting and outcomes; whether they abide by ethical principals and practice (Cohen et al., 2011, p.76). For this research, the ethical guidelines are mainly laid down by the Aston University (AU) Ethics Committee and also the Malaysian government. The major topics to take into account include confidentiality, informed consent, gaining access and acceptance in the research setting, as well as data protection.

#### 3.8.1 The researcher's side

In order to conduct this study, the first step is to submit the research proposal and research plans to the AU Ethics Committee. The research project can be conducted only with its ethical approval (please refer Appendix 10). This research complies with AU's guidelines as stated in 'RESEARCH CODE OF CONDUCT-REG/10/392'. The researcher also needs to comply with an ethical statement based on the ethical guidelines prescribed by the British Research Association code of conduct (BERA, 2011) for education researchers. In addition, as the main source of data collection is by using the interview method, the researcher needs to comply and adhere

to ethics and the regulation outline by Royal Academy of Engineering (2018) as well as British Sociological Association (n.d).

Apart from that, as the researcher is one of the staff at PBL institute, at where Case Study 1 is conducted, it is important for the researcher to clearly declare her position during the data collection process. This declaration is important in order to comply with engineering ethics as stated by Royal Academy of Engineering (2018) with regard to conflict of interest on the study conducted.

In addition to this, as the research will be conducted in Malaysia, a referral letter by the Director of Research Degrees from the Aston University has been sent to the institute as a proof of the research work being conducted (Appendix 11).

Apart from this, Bell (2014) highlight some additional personal codes that are relevant to this study as per Table 3.8:

Table 3.8: Personal Code Of Practice: For Negotiating Access, Following Ethical Guidelines And The Problems Of 'Inside' Research

1. Clear official channels by formally requesting permission to carry out the research
2. Speak to the people who will be asked to cooperate
3. Provide the participants with an outline of intentions and conditions under which the study will be carried out
4. Be honest about the purpose of the study and about the conditions of the research.
5. Decide what I mean by anonymity and confidentiality.
6. Inform participants what is to be done with the information that they provide.
7. Maintain strict ethical standards at all times
8. Only promise what I can deliver

### 3.8.2 State permission

In conducting research in an educational setting, permission from the approving body of agencies is obligatory (Wiersma, 1997). In order to collect data in Malaysia, official permission is needed from its Ministry of Higher Education and the Economic

Planning Unit (EPU) of Malaysia. Other ethical guidelines have been clearly identified before entry to the research site in order to avoid any unforeseen issues.

### **3.8.3 Institution level**

An official application letter has been sent to the selected institutions in order to obtain consent and access to them. In the letter, the researcher clearly describes the purpose of the project as well as the benefits from the study. Furthermore, the letter lists down those who are involved in the study and describes the conditions of the study. Furthermore, sensitive ethical issues such as maintaining the confidentiality of data and preserving the anonymity of the informants has been mentioned.

Since gaining entry may be a recurring problem, a brief proposal is developed and submitted for review by the 'gatekeepers' (Creswell, 2014). The topics addressed in the proposal include:

- i) Why the site was chosen for the study
- ii) What will be done at the site during the research study
- iii) Will it be destructive
- iv) How will the results be reported
- v) What the institution will gain from the study

For this research, a copy of application letter (copy of e-mail) as well as approval letter from both institute are attached in Appendix 12.

### **3.8.4 Participant involved at the research site**

Participation in the interviews is voluntary. This research gained informed consent and protected privacy by keeping names confidential (Appendix 13). The researcher will also avoid dishonest actions in the process. Before the interviews the researcher will review the protocol by asking permission to start as well as permission to record the interview. This permission is important because it can encourage the participants to trust the researcher and be open and honest during their interview. A voice recorder is used to record the conversation and brief notes are taken in order to document the interviewees experiences and their current practices in AL.

### **3.9 Research Journey**

The research work started after access was granted by related parties. A total duration of approximately 3 months was taken to complete the data collection process. The field work lasted from 11/8/2014 until 24/10/2014 which involved two case studies in Malaysia. The details of the journey process are summarised in Appendix 14.

### **3.10 Summary**

This chapter has provided an in-depth account of the research methodology used in this study. With regards to the research aim, objective and research questions, the use of multiple case studies was chosen as the most suitable approach in order to achieve the research aim. The data was collected by using semi-structured interviews as the main source which involved staff and management level while focus group interviews were used with the students, document analysis was used for data triangulation. All the interview data collected was further analysed by using thematic analysis in order to generate the findings. Upon completion of qualitative method, results are then used for quantitative approach in order to triangulate the findings together with literature. The following chapter will present the findings based on the case study conducted at the selected institutes.

## **CHAPTER 4 : QUALITATIVE FINDINGS FROM CASE STUDY 1 – PBL INSTITUTE**

### **4.1 Introduction**

The aim of this chapter is to present the findings from the first case study conducted in Malaysia, which focuses on PBL Institute. This chapter starts with a brief background on the selected institute before presenting the findings from this research. In order to gain a detailed overview of the situation at PBL, and to triangulate the data, the perceptions of lecturers, management and students were explored and brought together in such a way to help develop new knowledge in this area of research. Thus, this chapter will be structured by examining the views of lecturers, managements (managers) and students, who constitute three different stakeholders. In general, this case study will summarise findings from semi-structured interviews and focus groups in order to explore participants' in-depth perceptions of the issues discussed. A total of 20 lecturers and 4 management (managers) were involved in the interview, while 8 groups of students participated in the focus group (5 students in each group). Accordingly, each sub-section will start by presenting demographic data on each participant, followed by the participants' perceptions of AL implementation and the findings' themes. The findings will also highlight the challenges and limitations faced by each stakeholder before summarizing the findings of the AL implementation within the case study.

### **4.2 Institutes Background**

PBL Institute is located close to Malaysia's capital, Kuala Lumpur. The institute is a renowned organization that aims to produce highly skilled graduates. The institute has adopted a hands-on approach to teaching and learning in their engineering programs since its establishment in 1991. In January 2010, the institute chose to re-align its teaching and learning process by introducing a hybrid approach called PRO3BL, which constitutes Problem, Project and Production-Based Learning (PRO3BL). Figure 4.1 shows the structure of the 'PRO3BL' approach, which has been implemented within the 3-year diploma program.

The re-alignment of the teaching approach is to support the use of Active Learning in Malaysian Higher Education,. Thus, the institute was chosen to participate in this study based on its experience of implementing Problem-Based Learning as one

of its principal approaches to the teaching and learning process. For this research work, this institute will be called 'PBL Institute' for confidentiality and data protection purposes.

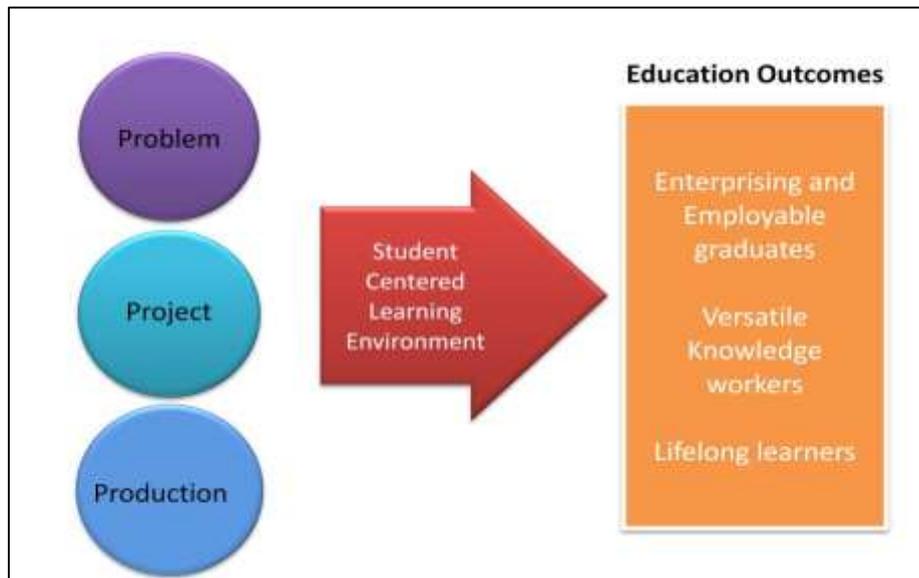


Figure 4.1: Model of Pro3BL With the Education Outcomes Chosen by PBL Institute

With regards to the AL implementation, the PBL approach commenced in July 2010, with the first-semester students who had enrolled for that academic year. The implementation of PBL had been planned to be gradually introduced into the curriculum as these pioneering students moved from one academic year to the next. In general, the PBL cycle starts by giving students a 'Problem Statement' to initiate the learning process. Then the students begin to identify what this problem is by means of the 3 K's (What they know? What they don't know? and What they need to know?). The PBL cycle is complete when the students are asked to present their findings in the class after conducting the necessary research.

#### 4.3 Staff Perspective in PBL Implementation: The Academic Experience

In this section, all data was taken from semi-structured interviews with some lecturers (also known as Technical Training Officers) from PBL Institute. A total of 20 lecturers were involved in this first case study. In general, selected participants are involved in teaching engineering courses in the PBL institute, either Mechanical or Electrical Engineering.

The first part of this sub-section provides a brief summary of the participants' background, including their education and work experience. The findings continue by investigating participants' perceptions of the AL implementation at their institute. The following sub-section will tabulate the themes found with regards to staff preparedness for PBL implementation. Challenges and obstacles faced by the participants are also revealed in the subsequent sub-section. The semi-structured questionnaire that guides this interview is attached in Appendix 15.

#### 4.3.1 PBL Institute - Staff background and demographic data

This sub-section contains a brief description of the participants' background. It is important to present this information, as it can provide an opportunity for readers to understand the quality of the interview conducted. In addition, by understanding participants' background, it can provide a better picture of the issues discussed, which indirectly aids further analysis.

Pseudonyms were given to all participants for reasons of confidentiality, while retaining authentic responses as outlined by British Sociological Association's and Royal Academy of Engineering ethical guidance. The pseudonyms given to the participants were only known by the researcher. The detailed demography of the participants can be seen in Table 4.1 and the summary of participants' profiles are shown in Figures 4.2 and 4.3 respectively.

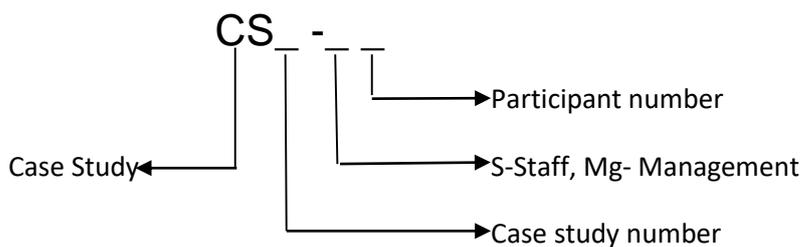


Table 4.1: Staff Profile and Background

Name	Highest Education Level	Work experience (years)			Involvement in PBL	Remark
		Before	Current Institute	Total		
1. CS1-S1	Masters	4	13	17	4.5 years	
2. CS1-S2	Masters	0.5	4.5	5	0.5 year	
3. CS1-S3	Masters	7	5	12	3 year	
4. CS1-S4	Degree in Mechanical Engineering	1.5	15	16.5	2 years	Experienced PBL during undergraduate
5. CS1-S5	Degree in Mechanical Engineering	7	7	14	3.5 years	Part time Masters student
6. CS1-S6	Degree in Industrial Design	0	0.75	0.75	0.5 year	Experienced PBL during undergraduate
7. CS1-S7	Degree in Computer Science	2	7	9	3.5 years	
8. CS1-S8	Masters	3	5	8	1 year	Part time tuition teacher
9. CS1-S9	Degree in Electronic Engineering	0.5	3	3.5	3 years	
10. CS1-S10	Masters	12	3	15	3 years	
11. CS1-S11	Masters	2	5	7	1 year	
12. CS1-S12	Masters	5	5	10	3 years	
13. CS1-S13	Masters	6	3	9	3 years	
14. CS1-S14	Masters	4	6	10	3 years	
15. CS1-S15	Masters	7	5.5	12.5	4.5 years	Part time PhD student
16. CS1-S16	Masters	1	4	5	4 years	
17. CS1-S17	Masters	5	6	11	3 years	
18. CS1-S18	Degree in Electric Electronic Engineering	10	1	11	1 year	
19. CS1-S19	Degree in Network System	7	20	27	4 years	
20. CS1-S20	Masters	6	6	12	2 years	Part time PhD student

Table 4.1 it shows that the 'highest level of education' for participants is either Bachelor degree level or Masters level. Figure 4.2 shows that 65% of the participants in PBL institute have a Master's-level degree.

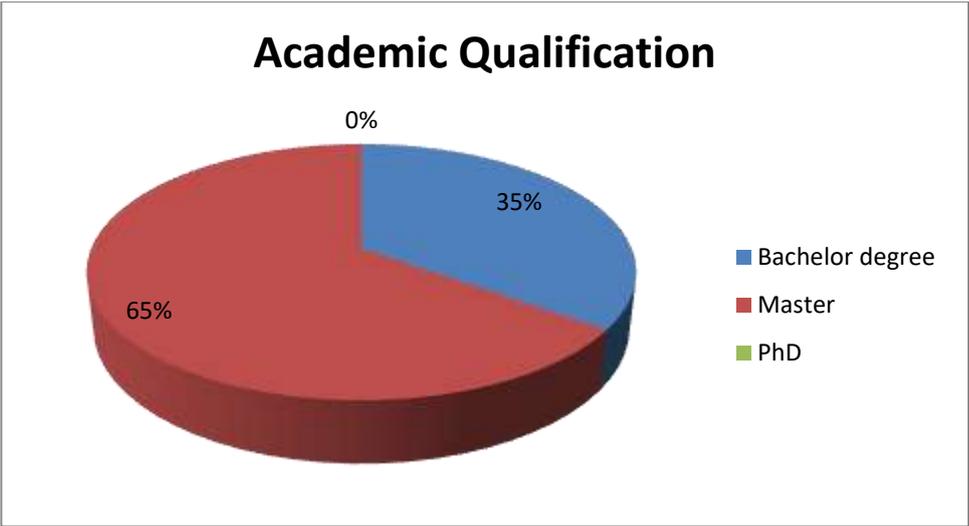


Figure 4.2: Staff's Academic Qualification

Figure 4.3 shows that the lecturers in PBL institute can be broadly divided into two groups: junior lecturers (up to 2 years' service) and senior staff (more than 5 years' service). Detailed demographic information from Table 4.1 also shows that the participants are in the range from fresh graduates up to more than 20 years of teaching experience in that institute. However, most of the participants involved have more than 5 years of teaching experience, hold senior lecturer positions, and have therefore acquired appropriate experience in the education field.

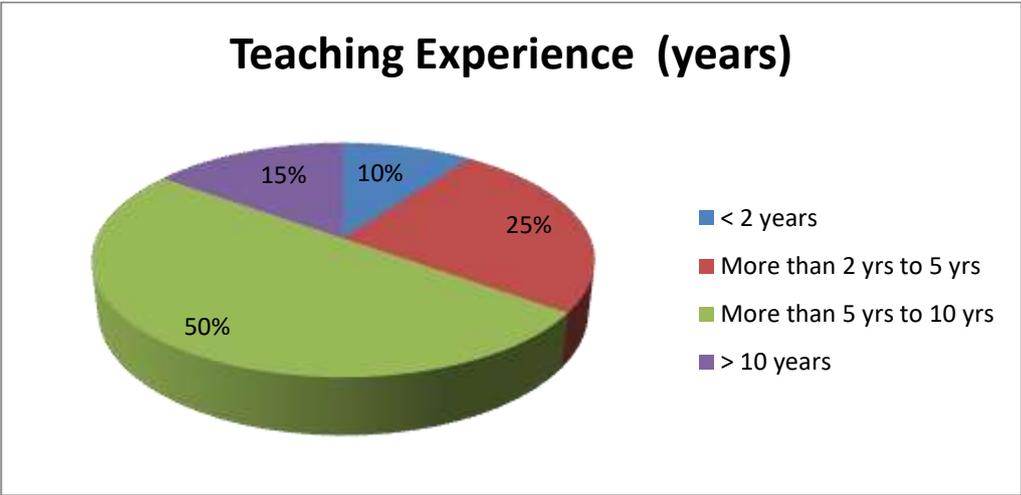


Figure 4.3: Staff's Experience in Teaching

#### 4.3.2 PBL Institute - Staff' perceptions of AL implementation

The results of the first finding in this section follow answering the first research question: '*What are the staff perceptions of Active Learning (AL) as an approach in engineering education?*'. The question was asked to participants in order to understand their opinion as well as to capture their feeling on AL being employed within their institute. Results received from the lecturers were found to be predominantly negative.

*"Frankly speaking, I don't think it is a good idea to use PBL."*

CS1-S19

Figure 4.4 shows in detail the responses to AL implementation. It reveals that the majority of participants have negative perceptions, as compared to only two participants who show positive reactions to the AL implementation.

Further findings reveal that some participants expressed dissatisfaction on PBL implementation, as it was instructed by the management, and thus they have to use this approach for their teaching and learning process.

*"We have to follow the rules. We have to follow the management needs, but deep inside, we think it's not suitable."*

CS1-S7

However, a few participants who possess industrial background agree that PBL adoption provides better way of learning to the students as the approach relates the real working environment during the learning process.

*"Teacher need to clearly inform the students that the objective of PBL is to train them to deal with real world of manufacturing or real world scenario."*

CS1-S10

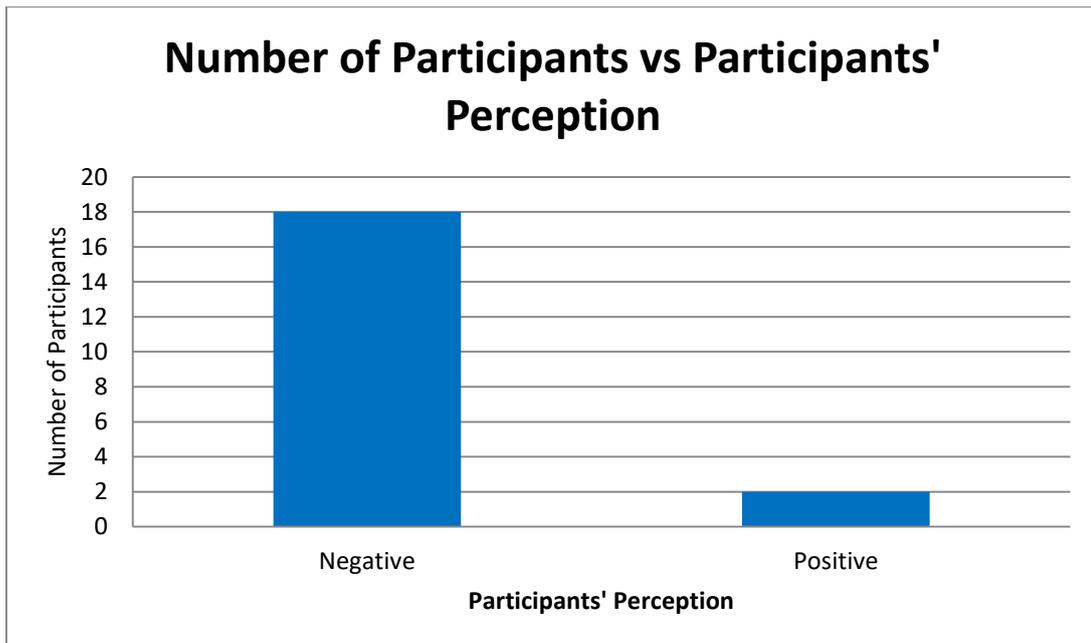


Figure 4.4: Staff's Perception on AL Implementation

#### 4.3.3 PBL Institute – Staff' Perception of Preparedness

In answering the main research question on ‘*How prepared are staff to adopt an Active Learning (AL) approach in higher engineering education?*’, the question was posed in order to investigate the participants’ perception of their preparedness. Table 4.2 below shows four common answers identified upon asking about their perception of preparedness in AL implementation.

Table 4.2: Staff perception of their preparedness

Answers	Quantity
Prepared	2
Not prepared	9
Partly prepared	5
Not sure	4

Figure 4.5 shows detailed responses to the question posed with regards to AL implementation within their institute. Results received from 20 lecturers revealed that almost 90% of them felt that they were neither prepared nor ready for the PBL implementation.

*“I think if we are talking about real PBL, I don’t think that I’m prepared.”*

CS1-S16



Figure 4.5: Staff Response to Their Preparedness

However, some participants suggested that they are trying their best to be prepared for the PBL implementation.

*“We just know about PBL in a surface level. We were not told the real PBL is all about, how you implement in engineering method, in engineering learning, and it is not 100% prepared, but we tried our best to be prepared.”*

CS1-S1

Nevertheless, after a few years of experience in PBL implementation, some participants gave positive responses on their preparedness level towards it.

*“For the past 2 years, I don’t really prepared, I only prepared with the problems, but not other things, but now I think if you ask me to do PBL in the class, then I know what I should do.”*

CS1-S4

#### 4.3.4 PBL Institute - The Finding Themes from Staff Perspective

In this section, the findings from the interview were collated in order to further understand staff preparedness with regards to AL implementation at their institute. In

addition, the findings are also important in order to answer these sub-research questions:

1. *What are the factors that influence staff preparedness in AL implementation?*
2. *How staff are prepared towards the implementation of Active Learning?*

Data from the interview was analysed by using thematic network analysis, as described in Chapter 3. A total of seven themes emerged with regards to staff preparedness, as shown in Figure 4.6. Detailed information with regards to findings from the thematic network analysis are as per Appendix 16.

With regards to the themes that emerged, findings from the interviews revealed the actual situation that happened within the institute based on participants' experience in PBL implementation since its initial stage. Thus, the results also indirectly disclose the staff preparedness with regards to PBL adoption in the PBL Institute. A further subsection examined detailed findings with regards to individual themes observed.

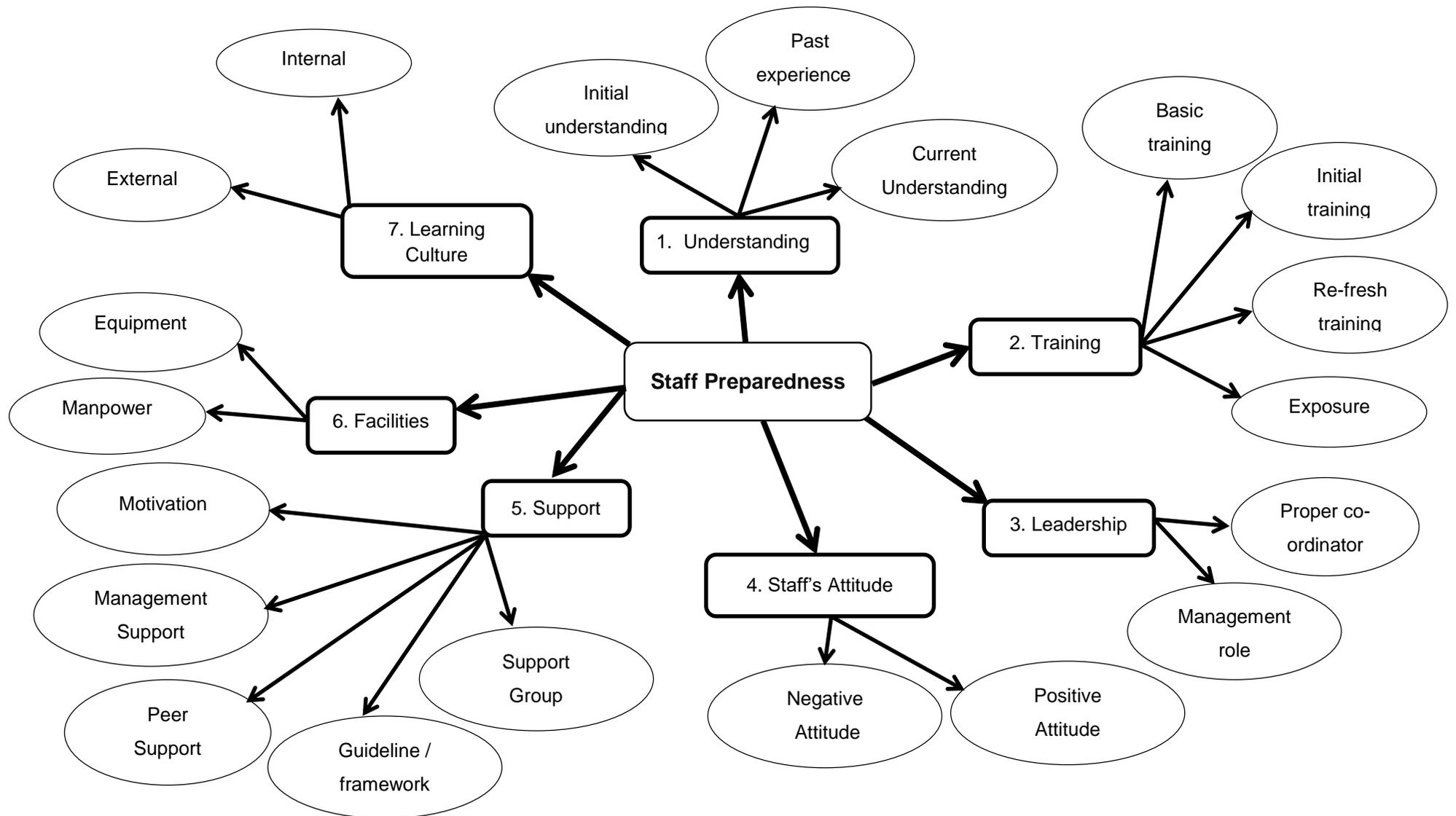


Figure 4.6: PBL Institute - Seven Main Themes Emerge on the Staff Preparedness Based from Staff Perspective

#### 4.3.4.1 Theme 1: Understanding

With regard to staff preparedness, one of the most important findings from this study is the staff understanding of the PBL approach. This first theme refers to the participants' understanding on the concept of PBL itself, which has been adopted as a teaching and learning approach within the institute. In addition, this theme has also been identified as the first theme which is important and will be highlighted and discussed further, as stated in Figure 4.7. The interview, also indirectly reflects and reveals how these staff members enact the PBL approach in their classes.

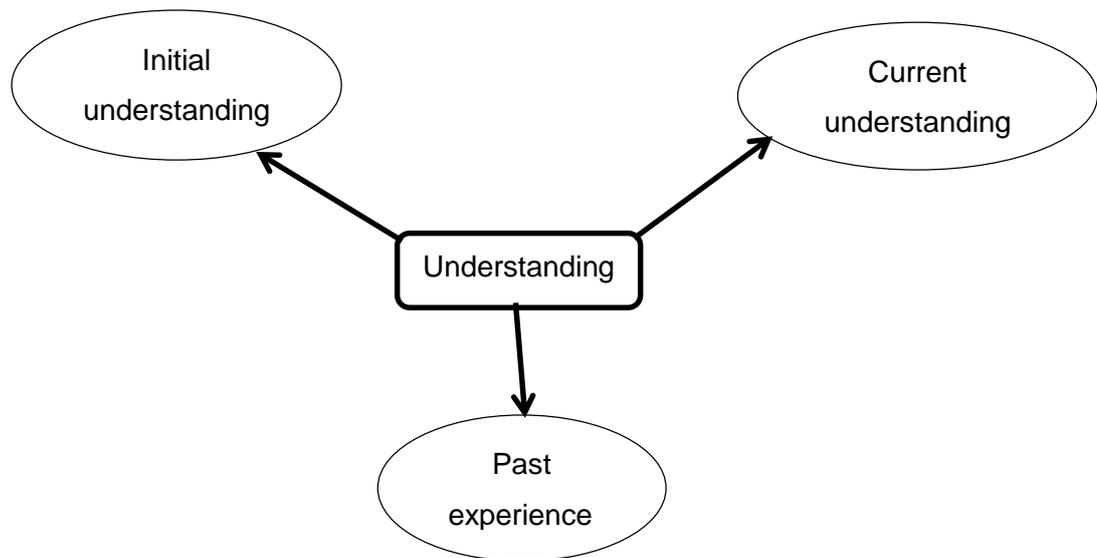


Figure 4.7: Staff - Main Theme and Sub-themes for Understanding

According to the interview, the majority of participants indicated that they do not have a clear understanding of the PBL approach, particularly during the early stage. Some of them suggested that they were quite 'blur' and confused when attempting to implement the approach.

*“At first stage or initial stage it is quite blur on what is this is all about. We just think that students are given with a problem and they need to learn by themselves.”*

CS1-S5

Further findings from the interviews conducted found that there are still a few staff that do not understand PBL correctly. Some of the participants still have an incorrect understanding of this approach, as they interpreted PBL as 'an assignment' or 'way of

doing assignments'. In addition, there is little evidence of improvement on their understanding even after 4 years of implementation.

*“So far, what I feel about PBL and assignment is the same thing.  
That's what I feel now. At the end, I didn't do PBL.”*

CS1-S2

As a result, findings also found that some of the participants understand PBL as just requiring students to solve a problem or question given to them.

However, only one lecturer from all the participants had a very good understanding of the PBL approach and managed to adopt it wisely.

*“For myself, I understand and clear enough.”*

CS1-S15

In addition to this, a few participants who possess an industrial background understand that PBL is an approach where students learn based on the real situation in an engineering field where students are exposed to the industry needs during the learning process.

*“In running PBL, student basically learn base on what the industry needs, and how they can apply when they graduate later”.*

CS1-S11

#### **4.3.4.2 Theme 2: Training**

Like the first finding theme, this theme emerged as all participants were asked to evaluate, in their opinion, the level of training provided by their management with regards to AL implementation in their institute. As training is a vital element as discussed in the literature review, findings for this theme may shed some light on the real situation with regards to staff preparedness.

From the interview, all participants made it clear that they have completed pedagogy training, as it is part of the compulsory training given in order to become a lecturer. However, some of them highlighted that the pedagogy training provided didn't include the PBL element, which made them unclear about the approach.

Thus, further findings revealed that the majority of participants expressed their concern over the lack of training, particularly on PBL implementation.

*“I feel that training is important. We lecturers do not have enough training for this PBL, I think.”*

CS1-S17

Detailed findings from the interview reveal four important sub-themes highlighted by participants, as shown in Figure 4.8.

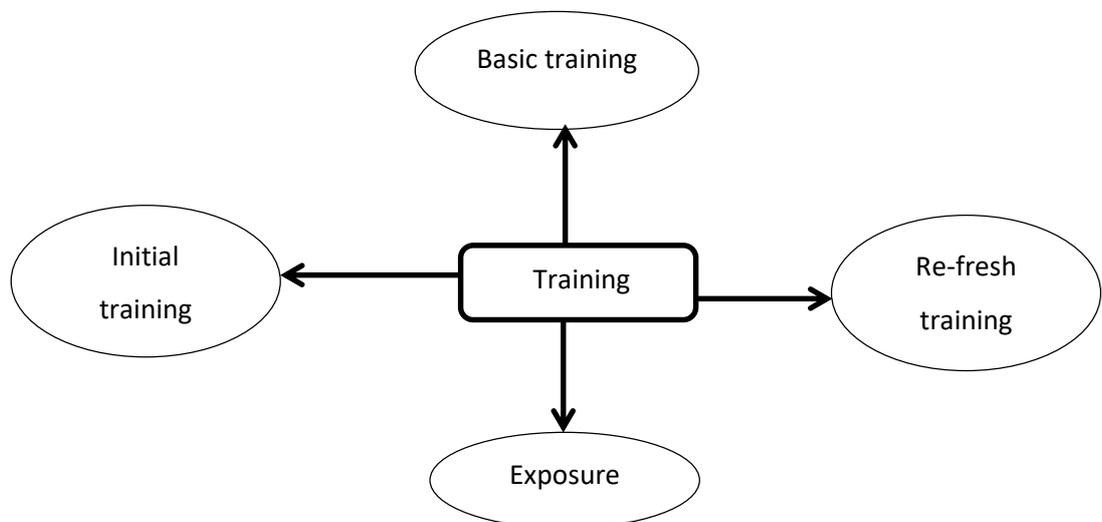


Figure 4.8: Staff - Theme and - Sub-themes for Training

From the findings, it is understood that only selected lecturers who were involved with ‘*Semester 1*’ modules had been chosen to undergo the training prior to implementation. Other staff were scheduled to attend similar training gradually upon PBL implementation during the following semester.

However, investigation also revealed that most of the participants highlighted that no training on PBL was arranged or recorded after that.

*“Just conducted once at an early stage”*

CS1-S2

Moreover, most participants expressed dissatisfaction with the training given as they considered it inadequate. Some of the participants even stated that they were not given proper training on PBL, but just ‘a simple briefing’.

*“That (PBL briefing) is the first time and after that I run the PBL straight away.”*

CS1-S11

Thus, due to a lack of training, some staff admitted that their level of knowledge on PBL is still the same even after a few years of implementation.

Aside from that, the results also showed that two participants never had a chance to be involved in any PBL training but were still required to use PBL for their teaching and learning. They were also sorry that they had never been selected for any training or briefing regarding PBL.

*“..to be sincere, I didn't attend any training.”*

CS1-S8

Only one participant demonstrated a positive response to PBL training. She noted that she attended the training only once and was then able to carry out PBL as required.

*“If everybody is clear and understands what has to be done, then I believe from that one workshop, it can be implemented. With one condition, it needs to be implemented, like what is being discussed in the workshop.”*

CS1-S15

While a majority of participants highlight that a lack of training hinder proper PBL implementation, a few participants highlighted that their previous experience and exposure from industry may help them to prepare for PBL adoption despite inadequate training given to them.

*“Usually I will create scenario where they will be divided into their groups, and then I will give a scenario whereby it was based on what I have experienced in my factory last time.”*

CS1-S18

In conclusion, a majority of participants highlighted the issue of a lack of training, as it is one of the key elements that affects proper PBL implementation. However, a few participants who previously worked in industry are able to relate their previous

experience into the PBL requirement in preparing PBL classes. In addition, the staff also suggested they should have refresher and additional training regarding PBL implementation. Based on their feedback, they need the training in order to refresh their knowledge of PBL as well as to keep them updated on the latest information regarding the PBL approach.

#### 4.3.4.3 Theme 3: Leadership

Regarding PBL implementation, feedback from participants also highlighted that leadership plays an important role in successful PBL implementation. Figure 4.9 summarises two important sub-themes highlighted under the theme derived.

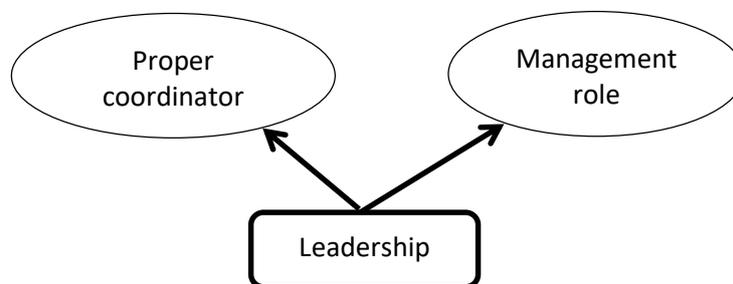


Figure 4.9: Staff - Theme and Sub-themes for Leadership

Since the PBL approach is considered to be a new way of teaching for the institute, most participants highlighted the importance of having a proper leader. Thus, the capability of the respective leader to orchestrate the change is vital. In addition, the appointed coordinator or leader is also required not only at the initial stage, but also necessary to continuously monitor the implementation.

*“I think we do need somebody who is positive and serious on this matter to take a lead. This is to make sure everything will be in place.”*

CS1-S13

Participants also highlighted a lacking of management roles with regards to PBL implementation within the institute. Findings revealed that there were a few briefing sessions conducted by the Deputy Managing Director of the institute, who initiated the PBL approach. Upon receiving consent from the top management to employ PBL, the implementation was initially to be done at the department level under the supervision of each department’s head. However, no monitoring and enforcement was undertaken

as there is no appropriate structure set-up upon PBL implementation that gradually led to improper implementation.

#### 4.3.4.4 Theme 4: Staff's Character / Attitude

This theme emerged as most participants believe that the staff attitude itself has a bearing on the preparedness for AL implementation. In addition, findings reveal that some work experience may help or influence the staff attitude itself. Thus, Figure 4.10 identifies two important sub-themes highlighted by participants.

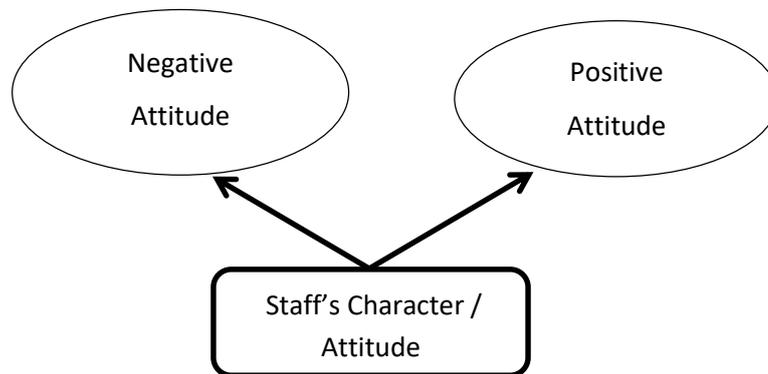


Figure 4.10: Staff - Theme and Sub-themes Staff's Character / Attitude

Findings from the interviews show that participants who have a positive attitude also possess a positive perception with regards to the PBL implementation. Thus, these lecturers manage to implement PBL as required by their management as well as accepting the challenge of implementation. However, some lecturers who are sceptical of PBL tend to find excuses not to use the approach, and refuse to implement it, which indirectly shows their rejection of PBL adoption.

*“The use of PBL is very good, but in terms of the behaviour of the lecturers and the students, I don't see that it helps much”*

CS1-S14

#### 4.3.4.5 Theme 5: Support

With regards to the question on *‘what are the mechanisms in place to support the staff in implementing Active Learning?’*, the question itself triggered an important theme that was widely discussed among participants. Initial findings reveal that the majority of the participants expressed concern over the lack of support received upon PBL

implementation. Detailed investigation identified five sub-themes highlighted by participants, as shown as in Figure 4.11

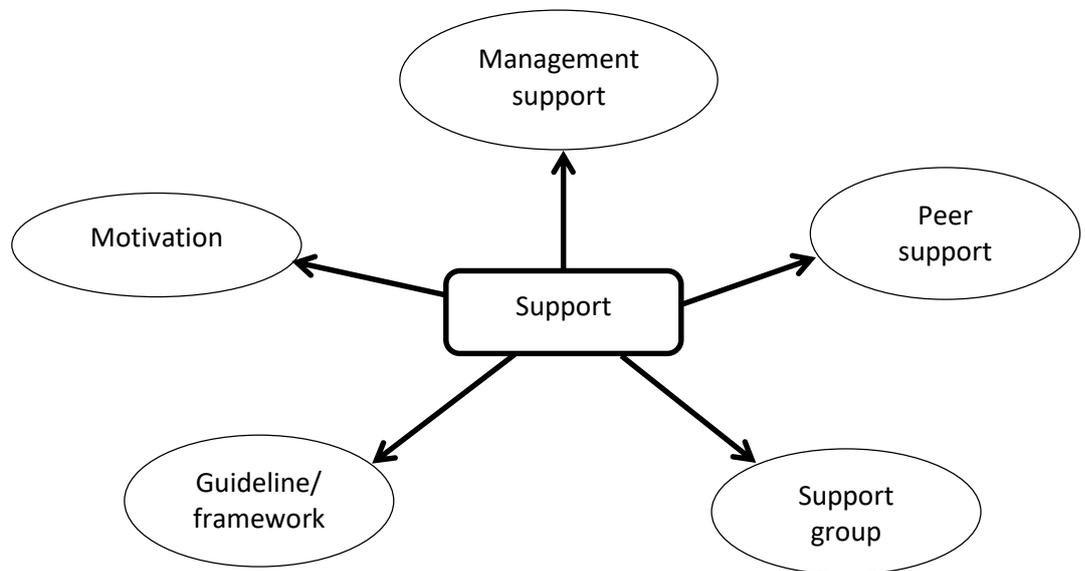


Figure 4.11: Staff - Theme and - Sub-themes for Support

#### Management support

Most participants expressed regret over this issue, as they believe there is a lack of support from the management. The majority of them highlighted that the staff preparedness for PBL implementation deteriorated due to inconsistent support from management.

*“I think no management support. They just leave with the lecturer. I think they also don’t care about the PBL anymore (laughing). As long as we do the PBL, they will be OK, that’s it”*

CS1-S17

With regards to this issue, some participants also highlighted that the management needs to be aware of the real situation within the campus in relation to PBL implementation. This is due to cases where a few lecturers are found not implementing PBL, as required by management. In addition, findings from the interview also revealed that a few lecturers went back to using a teacher-centred approach instead of PBL after some time.

Thus, responses from participants suggested that the management team should be properly involved in PBL implementation. Some of the participants raised the idea that proper enforcement or monitoring should be done by the management in order to make sure the implementation is correctly in place.

### Peer support

Regarding peer support, most participants believed that they received appropriate support from their colleagues. A majority of them also said that their colleagues had contributed necessary support towards PBL implementation. Responses from participants reveal that they are having informal discussions with colleagues as one of the ways to support PBL implementation. In general, the discussion was done on their own initiative among their sub-unit or course based.

*“Yes, our own initiative. Currently in my unit, we try to discuss again on how to do (the PBL) and check until it becomes better.”*

CS1-S10

However, a few participants also highlighted that they are still not sure how to support each other as they themselves are not confident in PBL implementation. As the implementations are mainly a result of their own initiative, some of the participants are unsure of the correctness of the implementation. Thus, they feel it is quite difficult to organize a proper discussion.

Some participants raised some negative issues regarding support from their colleagues. A few participants remarked that there were some cases where lecturers refused to share their knowledge and were being secretive regarding PBL implementation.

*“Team work, socializing, asking information, they just can’t be bothered and some of them are secretive. They may know something else but just say ‘I don’t know’. That the things now...”*

CS1-S19

As a result, the discussion activity will only involve lecturers who are willing to share the information and are committed to adopting the approach. Other participants

highlighted the fact that they have some difficulties in discussing about PBL, as some of their colleagues do not want to use the same approach.

### Support group

With regards to this sub-theme, a common finding highlighted by participants is a requirement to have a proper platform or group to discuss the PBL matter. The purpose of this platform or representative group is mainly as a 'support group' for the PBL implementation as well as a reference centre for any issue that may arise.

*"I feel that the PBL committee must exist in order to make sure that PBL is running and we do have somebody to refer to."*

CS1-S1

Further findings also uncovered that some lecturers who had attended a series of training during the initial stage were also appointed to be the steering committee for the PBL support group. However, the group was found not to properly function as per the plan.

### Guideline, framework

A majority of the participants also highlighted the absence of guidelines that hinder proper AL adoption. In other words, they require proper procedures or frameworks in order to ensure correct implementation. These guidelines are important as it can be used as a reference for the staff in order to understand how to implement PBL correctly.

*"There should be a proper procedures that can be used as guidance all the time or we must have somebody to refer or centre to discuss, portal or etc."*

CS1-S20

In preparing the guidelines, some staff suggested that the information should include the steps of implementation as well as assessment procedures with regards to PBL implementation. Furthermore, it should be standardized based on the mode of subject.

## Motivation

Some participants expressed concern that the staff also required motivation in order to encourage them to implement PBL. Issues such as good working environment, remuneration and rewards were among the main concerns highlighted by the staff.

*“Try to motivate, give some rewards to staff who excellently doing PBL for example, that will give some motivation.”*

CS1-S4

### 4.3.4.6 Theme 6: Facilities

This theme emerged since a majority of participants highlighted difficulties and challenges that they faced during AL implementation. As proper facilities is a basic requirement for a successful PBL implementation, the facilities provided did not seem to be consistent with the goal to implement AL within the institute. Figure 4.12 identifies four sub-themes highlighted by participants regarding facilities issue.

Only one participant felt satisfaction with the facilities provided. A majority of them expressed the fact that the facilities provided are inadequate for the approach.

*“To be sincere, they encourage us to run this PBL, but so far in terms of implementation... Sorry to say, in term of facilities, it is still not complete yet”*

CS1-S8

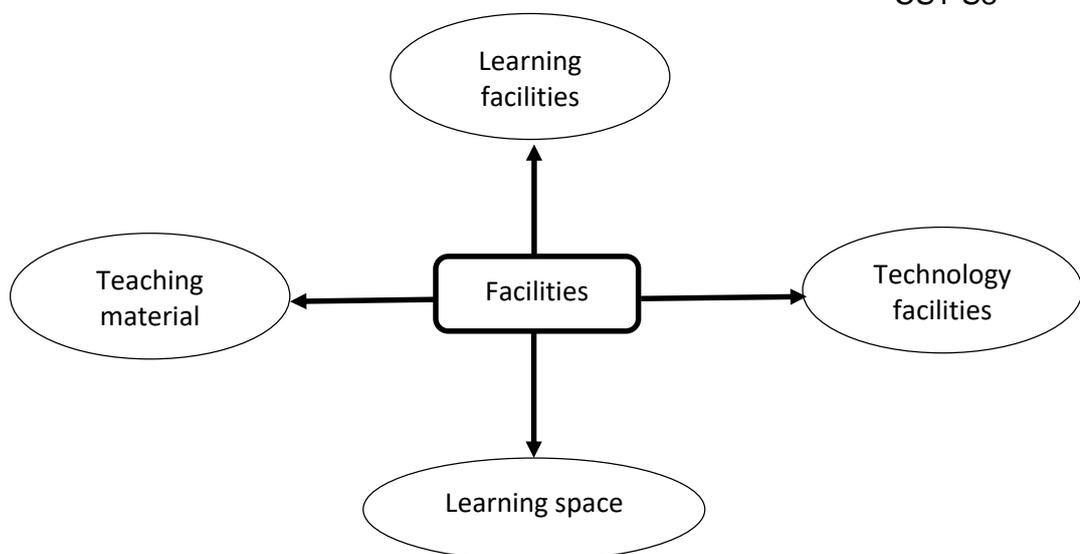


Figure 4.12: Staff - Theme and - Sub-themes for Facilities

One of the main issues highlighted by most of the participants is the internet facilities. As the PBL approach requires the students to find their own information, online information is the most favourable resource used by the students, unlike the use of books. However, the IT facilities provided by the institute are considered unsatisfactory.

Detailed findings on the internet facilities revealed some restrictions placed on the facilities provided, such as limited duration and coverage. In other words, internet facilities are limited to office hours, and available only around academic blocks. Participants also added that no internet facilities were provided in the student's hostel which discourages those students pursuing the PBL approach. Further information also found that the students need to go to the academic blocks if they needed to use the internet facility during the night.

*“Basically for resources, it's very critical. I really hate it! Sorry, no offence. They block so many things for the internet!”*

CS1-S19

In addition to this, most lecturers also expressed irritation about the limited accessibility of certain websites, such as YouTube, which, according to them, is one of the free websites that really helps the students to access information.

Besides internet facilities, some of the lecturers also highlighted that there is limited room and space available to perform PBL activities. In addition, the class room layout is unsuitable. However, information received from participants shows that some initiatives have been introduced by certain departments in order to provide rooms for PBL.

*“In term of environment in class, the layout for example is not suitable within the PBL system.”*

CS1-S11

Participants also highlighted limitations on computers and laptops provided for the IT facilities due to the limited availability of computer rooms within the academic blocks. In addition, a majority of the students in the institute do not possess personal laptops and computers to use due to students' economic background, which indirectly restricted the implementation.

A few participants also highlighted the fact that the institute does not have enough manpower – the necessary technicians to run a lab, for example. Some of the lecturers also complained that they themselves need to handle the lab, in addition to fulfilling their main job as a lecturer.

In conclusion, a majority of the lecturers indicated that the facilities provided are not sufficient, and have hardly seen any improvement since their implementation. Thus, this situation had negatively affected the staff in continuing the implementation of the PBL approach.

#### 4.3.4.7 Theme 7: Learning Culture

Another important theme raised by participants is learning culture and where it indirectly influences staff preparedness towards the implementation. As AL is an opposite approach to the Teacher-Centred one that has been used for quite a long time, the findings under this theme have generated two important sub-themes that need to be considered, as shown in Figure 4.13.

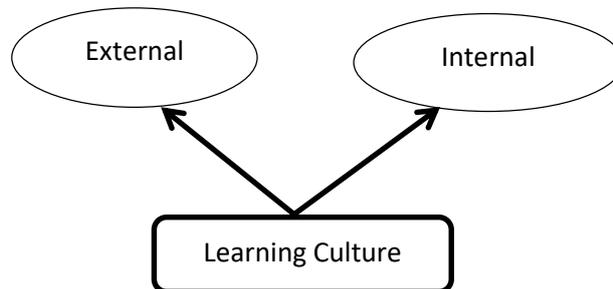


Figure 4.13: Staff - Theme and - Sub-themes for Learning Cultures

A majority of participants pointed out that the former education system, which is teacher-centred, is one of the major barriers to implementing a PBL approach. This situation is defined as an external culture that has shaped the students' educational background. Thus, the majority of the participants suggested that the students require necessary exposure to a new system before they become involved in PBL. They also added that simple briefings given to the students during orientation week were not sufficient to prepare them for proper implementation. In addition, more awareness training is required, particularly for the students to gain a more sophisticated understanding of PBL.

*“From my point of view, it's look like our education system had taught them to just getting the information, read information or memorizing information and proceed on whatever they have but they are unable to ask question, they are unable to ask like why, what it is for, why it behave like this and the background to those area .”*

CS1-S19

The role of teacher as a knowledge provider is another factor that influences the lecturers, and deters them from using the PBL approach correctly. Since a majority of the lecturers were from a teacher-centred education background, the teacher's role as knowledge provider had influenced their tendency not to use a PBL approach, especially when they were struggling to finish the syllabus within a restricted period of time.

One participant expressed the interesting fact that the implementation of PBL is quite hard to achieve, as students in Malaysia are not used to a reading culture. Thus, the students tend to wait and receive the knowledge rather than looking for information. Again, the absence of a reading habit had failed to encourage the students' interest and made it hard for them to seek out information independently.

*“..but the culture of reading is almost zero...”*

CS1-S19

A few participants also highlighted that the implementation also requires parents to understand the approach as well. This is due to incidences where some parents had complained to the institute that the lecturers were not teaching their children anymore.

*“Their parents need to be briefed about this and not only the student.”*

CS1-S5

Feedback from other participants also highlighted issues such as an improper environment within the institute, which was also another factor that negatively affected the PBL implementation. This can be defined as an internal factor which indirectly influences the PBL implementation.

The interviews disclosed the fact that there are still many cases where lecturers do not employ PBL, as required by management. In addition, the failure of the lecturers

to adopt the implementation also indirectly discourages the students from adopting, and engaging with, AL.

Thus, some participants raised concerns that the culture issue must be confronted by creating an environment that promotes the approach, including forging an appropriate learning culture within the institute.

*“If we depend on our current small surrounding, I think it supports this, but if we look at overall support, it’s quite hard to say.”*

CS1-S9

While most participants believe that the culture acts as a barrier to change, there is still hope for adopting this approach, as some participants think that PBL implementation can change the students’ learning ability and shape a new culture.

*“It’s a good start to our culture.”*

CS1-S15

#### **4.3.5 PBL Institute - Challenges faced by staff in PBL implementation.**

Findings in this section answer the sub-research question on ‘*what are the challenges faced by the staff in implementing Active Learning?*’. Figure 4.14 shows the challenges faced by the staff during PBL implementation in their institute.

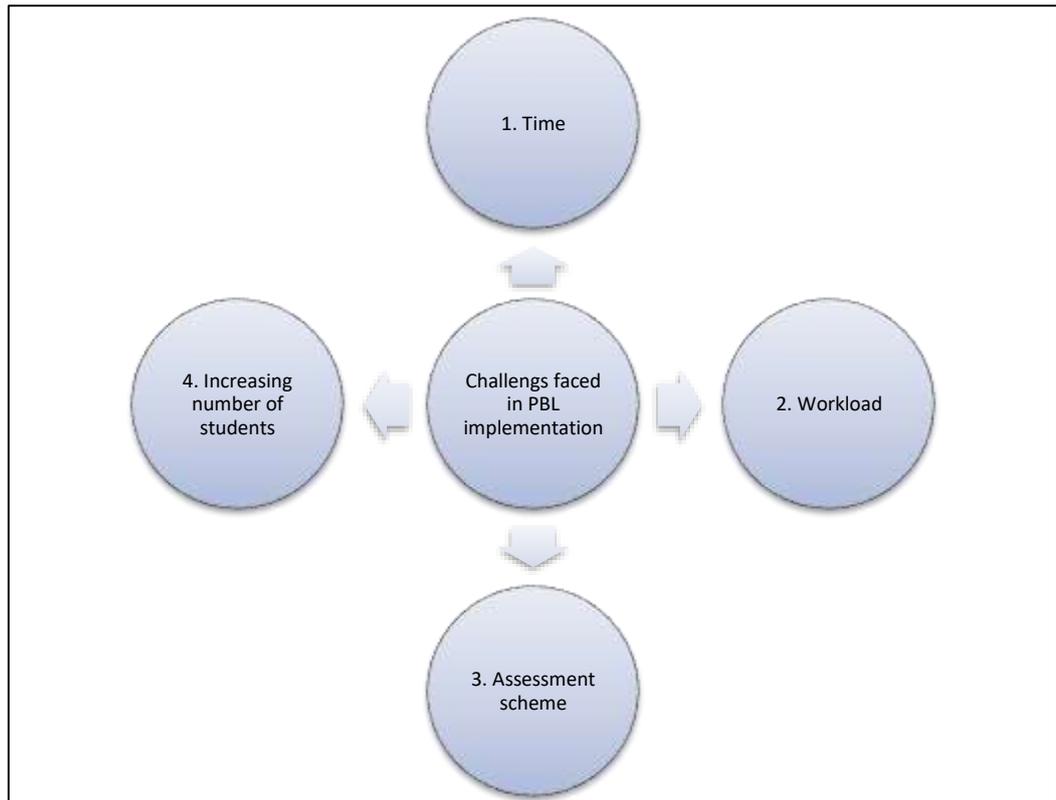


Figure 4.14: Challenges Faced by Staff in PBL Implementation

#### 4.3.5.1 Time

Most participants asserted that the PBL approach was taking more time when compared to traditional methods of learning. This is due to the time allocation that is given to the students to find necessary information during the learning process.

Findings revealed that lecturers are given either 2-hour classes for theory subjects or 5-hour classes for subjects that involve a practical element. Thus, the limitation of time allocation had forced them to ‘spoon feed’ the students as they were running out of time to finish the syllabus, especially towards the end of semester.

*“One more thing is time factor. We need to finish everything for exam.”*

CS1-S16

Apart from insufficient time allocated for PBL activities, a few participants also raised concerns over the students’ timetables being allocated differently based on the courses taken. Feedback from participants highlighted that some groups of students are facing a crammed timetable within half of semester, while other groups will have

ample sessions throughout the whole semester. Thus, the situation discourages the lecturer from employing a PBL approach, and a 'spoon-feed approach' is consequently adopted.

#### **4.3.5.2 Workload**

Regarding this issue, a few participants expressed that their workload was too heavy to handle with regards to teaching duties. In other words, responses from participants highlighted that they were given too many classes within a week. There were cases where some participants were required to teach for 10 straight hours in a day with only one hour's break in between. Thus, participants complained that their preparedness for classes was significantly affected.

*"I think the issue is the time. They have to be realistic on time spend with regards of subjects and also amount of students. Normally we are rushing for the next class."*

CS1-S16

Participants also expressed dissatisfaction about the system used, as the lecturers felt burdened even during students' holidays. Some of them highlighted that they were struggling to complete the marking for the exam in addition to attending required training. Furthermore, their workloads sometimes make them unable to take leave.

#### **4.3.5.3 Assessment scheme**

A majority of participants expressed concern over the improper assessment used for PBL. Detailed investigation revealed that most participants were not sure how to complete assessments for PBL activities. In addition, a majority of participants also revealed that they do not have proper assessment for the PBL. In general, the assessment is not standardized.

*".. the most important is how to do the assessment, because currently even myself didn't clear about on how to do a proper assessment for PBL."*

CS1-S8

Some participants suggested that the marks allocation system for assessment is sometimes inappropriate as there are many aspects to be covered during the learning process. In addition, participants also do not have any guidelines on what are the elements that should be assessed during the process.

#### **4.5.3.4 Increasing numbers of students**

In using PBL as their teaching and learning approach, participants also highlighted that they are facing difficulties due to a sudden increase of students in recent intakes, a consequence of which is difficulty in controlling classes, as the amount of students is double what it was. Since the institute is designed to accommodate a maximum number of 25 students per class, the situation is currently unfeasible as staff have to handle up to 45 students per session.

*“...in the case that I have to combine 2 classes, so, the number of students are quite huge and the class is become bigger. I can't give full concentration to each of the student...”*

CS1-S12

As a result, the equipment provided within the lab is insufficient. It is also hard for the participants to employ PBL as they are unable to effectively monitor the students. This situation has discouraged the participants from pursuing the PBL approach as they feel the facilities are inadequate.

#### **4.3.6 PBL Institute - Suggestions for improvement by staff**

The interview responses included suggestions made by the participants in order to improve staff preparedness with regards to PBL implementation within their institutes. These are illustrated in Figure 4.15.

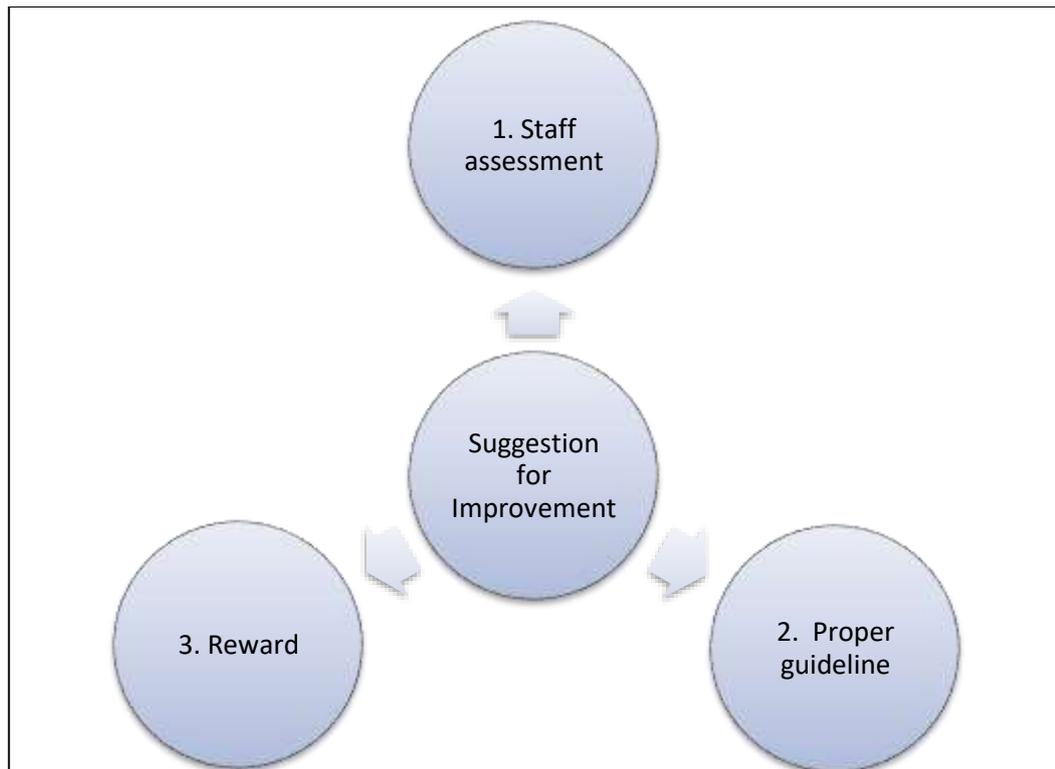


Figure 4.15: Suggestion for improvement by Staff

#### 4.3.6.1 Staff assessment

With regards to PBL implementation, one notable suggestion from participants is to organise a proper assessment with regards to the staff preparedness for employing a PBL approach. Findings from participants reveal that the institute only conducted an assessment in order to verify their capability for teaching, which was normally performed after training which was mainly related to pedagogy. However, there is no specific assessment undertaken in relation to PBL implementation.

With regards to the assessment, the content should include the minimum training requirements undertaken by the lecturer aside from practical assessment on the PBL implementation itself. This is to make sure that each member of staff possesses a good understanding of how the approach should be enacted, and training should be made mandatory if the staff member is found to be incompetent and badly prepared for proper implementation.

#### **4.3.6.2 Proper guideline**

A majority of participants indicated that the absence of proper guidelines or framework had caused most of the staff to be unprepared for the implementation. This is due to the fact that the staff were not sure of how to be prepared and what were the things that they needed to prepare in order to perform the AL approach. Apart from that, since the teaching and learning in the institute adopts a hands-on approach in some of its sessions, the majority of them highlighted the need for standardisation in implementing a PBL approach in order to make sure objectives were met.

In preparing the guidelines, suggestions from the participants also highlighted that the framework should cover the roles of management, staff and students in order to make sure that the implementation is properly carried out at all related levels.

#### **4.3.6.3 Rewards**

In encouraging the staff to be prepared for the AL implementation, having a reward or appropriate remuneration was found to be a common suggestion by the participants. Responses from participants also reveal that the work and effort that they have to invest are not equivalent to the remuneration given, as they complain that there is no difference between them and the staff who adopt a traditional approach. Hence, suggestions were posited on appropriate mechanisms for how the AL implementation can attract staff to contribute.

#### **4.3.7 Summary of Staff Perspective in the PBL Implementation**

From the interviews conducted, it is important for the researcher to understand how PBL is implemented within the institute. Thus, Table 4.3 presents the summary of findings on the staff's practice and experience in the PBL Environment. Table 4.4 further summarises the finding themes with regards to staff's perception of their preparedness in AL implementation. Challenges faced by staff are summarised in Table 4.5 subsequently.

Table 4.3: Summary of Staff Practice and Experience within PBL Environment

	Description	Staff Practice and Experience
AL Awareness	AL approach	PBL
	AL starts	Since 2010
	AL adoption	Every subject
	AL venue	Classroom
	AL implementation	Based on individual initiative
Experience in AL implementation	Student's learning style	Solving problem
	Written guideline	No
	Training	1 day (Only for selective staff)
	Institution supervision	No

Table 4.4: Summary of Staff's Perception of Their Preparedness Based on Finding Themes

Theme	Description
Understanding	<ul style="list-style-type: none"> <li>- Confusion over definition of Problem-Based Learning</li> <li>- Not clear</li> </ul>
Training	<ul style="list-style-type: none"> <li>- 1 day training</li> <li>- Only for selected staff only</li> <li>- No continuous training</li> </ul>
Leadership	<ul style="list-style-type: none"> <li>- No proper leader appointed</li> <li>- No supervision from institution</li> <li>- No clear direction given</li> </ul>
Staff Attitude	<ul style="list-style-type: none"> <li>- Individual initiative</li> </ul>
Support	<ul style="list-style-type: none"> <li>- Insufficient support from management and colleagues</li> <li>- Lack of motivation</li> <li>- No written guideline available</li> </ul>
Facilities	<ul style="list-style-type: none"> <li>- Insufficient facilities provided for AL adoption</li> </ul>
Learning culture	<ul style="list-style-type: none"> <li>- Influence from previous learning approach which is teacher-centered</li> </ul>

Table 4.5: Challenges Faced by Staff in PBL Implementation

<b>Challenges</b>	<b>Description</b>
Time	Limited time available
Workload	More workload
Assessment	- Not available - Not standardised
Student Numbers	Higher enrolment

As a conclusion, findings from this section reveal that staff preparedness in implementing PBL varies within the institute. This situation impacts on improper PBL implementations. Despite its importance, training was found inadequate to equip staff, in particular during the initial stage of implementation. However, staff who possess experience in industry show positive input with regards to PBL adoption. Further in-depth interviews also discovered that improper planning, mostly to do with training, was the key contributor to this state of affairs. This finding supported the necessity of preparing the teaching staff fully before any new approach was adopted.

In addition, the research results make it clear that PBL was implemented in the institute merely because this new approach was made compulsory by the management. The absence of a capable leader exacerbated this situation, as no monitoring was arranged to make sure that PBL was implemented correctly. Generally, its implementation relied on individual effort and initiative, and this has led to different 'versions' of PBL in circulation. Furthermore, there is no proper mechanism recorded specifically to support the staff for the PBL implementation.

#### **4.4 Managements' Perspective in PBL Implementation: The Managements' Experience**

This section outlines the results of the interviews with the management, which involved the Deputy Managing Director of Education of the institute, Head of Departments (HODs) as well as the newly appointed Head of Section for PBL (in 2014). The findings of the responses brought forth the categorizing and identification of the themes where each group was asked to seek the perceptions of management and to achieve an understanding of the role of management in staff preparedness. The results of the interviews also reflect the research objective listed in Chapter 1.

In addition, the results also facilitate triangulation with the findings from staff perceptions as in section 4.3. PBL implementation done at PBL institute is also one of the initiatives created by the management to enhance teaching and learning in light of the current education challenge; the management's perceptions are also important in order to find the real impression of its successful implementation. The semi-structured questionnaire that guides this interview is attached in Appendix 17.

#### 4.4.1 PBL Institute - Managements' background and demographic data

This sub-section provides a brief description of the participants' background where pseudonyms were given to all participants in order to ensure confidentiality. The participants' background information is important in order to provide a better picture of the issue discussed and indirectly helps further analysis. Detailed information on participants is provided in Table 4.6 below. Pseudonyms are given based on info in section 4.3.1.

Table 4.6: Participants' Profiles for Management

Name	Highest education level	Working experience (years)			Involvement in PBL (since)
		Before	Current Institute	Total	
1. CS1-Mg1	Masters	4	22	26	2010
2. CS1-Mg2	Masters	5	22	27	2010
3. CS1-Mg3	Masters	9	20	29	2010
4. CS1-Mg4	Masters	2	12	14	2010

#### 4.4.2 PBL Institute - Management perceptions of AL implementation

Data in this section reveals the management's perceptions of AL implementation within their institute as well as illustrating their perceptions of the staff's preparedness for PBL implementation. The results also reveal the management's experience of the implementation, as well as reflecting the overall performance of the staff.

All participants said that the PBL implementation is not 'a new approach' introduced within the institution. Indeed, further explanations reveal that the institute

has been using a 'hands-on' approach in their curriculum since the beginning of its operation in 1992, which is also widely accepted by the industry. As the institute also places emphasis on 'student-centred learning', the use of mini projects is widely implemented within the course by most of the staff. Thus, the implementation of PBL approach is said to chime with the institute's aims, in order to produce students who possess several competencies, namely in technical, learning as well as social areas.

*"..we do it because we want to be aligned of what we had done in here. So we have so-called final year project which is actually production based because at the end of the project, students have to come out with a comprehensive project. They also have small projects in the departments which are project based learning and what is not there is problem based learning."*

CS1-Mg3

Thus, the decision to implement a hybrid AL, which is called 'PRO3BL' and comprises Problem, Project & Production-Based Learning, is said to re-align their approach as the students have been involved in a variety of projects, as well as handling machines since early in the semester. The involvement of students in final-year projects is similar to the 'Production-Based Learning' approach.

From the management's point of view, a majority of the participants suggested that the staff were not keen to adopt this approach and reluctant to implement it. This situation was recorded especially during initial stage of the 'PRO3BL' introduction.

*"The only challenge that we have at that time were the staff, as they are a bit sceptical."*

CS1-Mg2

Further findings also reveal that the institute had been introduced to student-centred learning before. However, the implementation was not fully completed and, consequently, this situation indirectly gave the same negative perception to the staff as when the management wanted to implement this 'PRO3BL'.

*"For them, these are new things and we do introduce other approach before and unfortunately it was all half way done."*

CS1-Mg2

#### **4.4.3 PBL Institute - Management's perception on staff preparedness**

In examining staff preparedness, initial responses from participants showed that most of the management believed that their staff were ready to implement the approach. However, they had to admit that not all staff are, in fact, prepared to implement the approach as expected when they found many problems arising after a few months of implementation.

*"I think the pre-requisite is there but not to say that they are well prepared but they have the pre-requisite."*

CS1-Mg3

As the implementation of PBL was not as expected, the situation had triggered various negative responses from the staff. Further discussion in the following section explores findings on related themes that are associated with the staff preparedness in AL implementation within the institute.

#### **4.4.4 PBL Institute - The Findings Themes from Managements' Perspective**

In this section, the findings themes based on thematic analysis observed are similar to the themes discussed in section 4.3. A total of 8 themes were identified, as shown in Figure 4.16 below with two new themes added which are 'communication' and 'planning'. Thus, this section also validates the findings discussed before. Detailed information with regards to findings themes are as per Appendix 18.

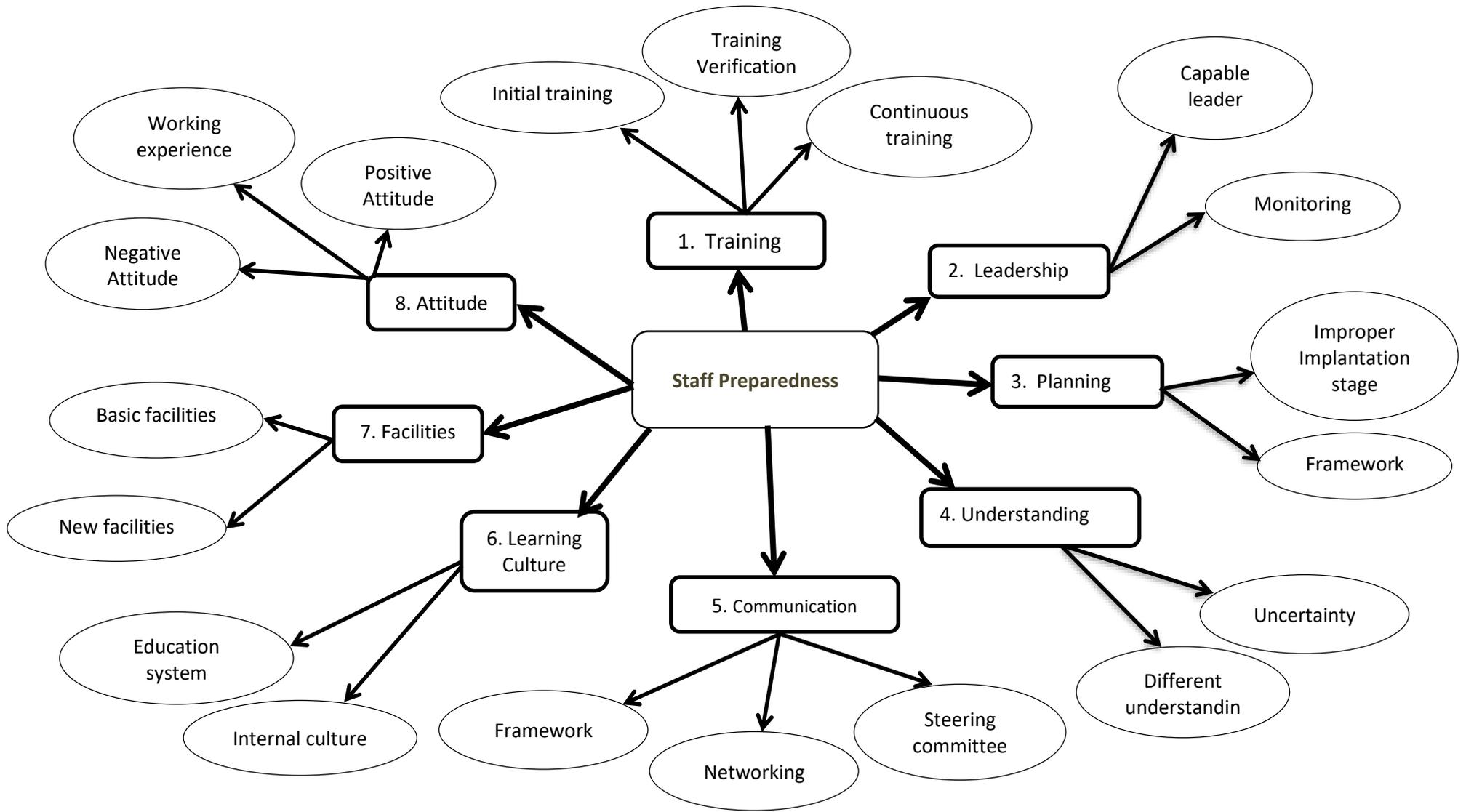


Figure 4.16: PBL Institute - Eight Main Themes Emerge on the Staff Preparedness Based from Management Perspective

#### **4.4.4.1 Theme 1: Training**

A majority of the participants admit that the staff do not have enough training pertaining to AL implementation within the institute. It was understood that the preparation to introduce the AL approach within the institute was done less than 6 months prior to the management decision to implement the approach.

*“Prior to that (PBL implementation), I think 4 to 6 months before that. We have 3 days workshop on PBL awareness. After that we continue with PBL crafting problems.”*

CS1-Mg3

Again, the training is only given to certain lecturers who were involved in the first semester subject. Thus, this situation creates misinterpretation within the staff as the information is not well distributed among them.

*“We started by identifying the teachers who teach semester 1 subjects to create the awareness and also to give them the concept and also the philosophy of PBL. We have workshop and also send them to ‘ABC Institute’ for some exposure about PBL.”*

CS1-Mg3

It was also understood that the training was not done properly, since many of the new staff are believed not to have sufficiently understood the AL employed by the institute. Thus, it also shows that there is no proper planning on training given to them. In addition to that, there is no training recorded by the institute. However, findings found that there was some training done as a result of individual initiative.

#### **4.4.4.2 Theme 2: Leadership**

A majority of the participants highlighted that the lack of staff preparedness was due to the absence of proper leadership. Detailed investigation revealed that the PBL implementation during the initial stages was planned to be conducted based on the department level. Thus, the monitoring of the implementation is said to be done by each HOD.

*“... by right all HOD should be able to monitor and to coach. Monitor is one thing, but having the ability to coach all the champion that we develop should be one way that everybody is doing it. So at the end of the day, the champion I can see that when there is no top down, they are beginning to see that they are not working.”*

CS1-Mg3

Further findings for this issue found that, most people appointed by the HODs to lead the approach failed to carry out the task as expected. This is due to various reasons, including resignation as well as the person in-charge furthering their study abroad.

*“We don't really have person in charge in the department level at the first place, and most people who know about this are from other department. We don't have somebody who can lead us on this and I did appointed one HOS to in charge of this but it didn't work. A new person in charge was appointed but now he is continuing his study abroad.”*

CS1-Mg2

Apart from that, one participant also highlighted that the appointed leader was also involved in other activities, which prevented them from concentrating on the task given.

#### **4.4.4.3 Theme 3: Planning**

The theme 'Planning' is a new theme highlighted by the participants with regards to staff preparedness. From the management point of view, all participants agree that improper planning at the initial stage has caused improper implementation within the institute. In other words, proper planning is crucial especially during the initial stage as it will affect the proper implementation as a whole. In addition, the absence of a proper framework and policy has worsened the situation, as the staff are implementing the approach without proper guidance.

*“And I think what happen now is a bit unmanageable. I can say that we don't plan properly as we don't have enough time to*

*know about the PBL as well as to get to know the equipment used for the subject. So I think we need to have proper planning.”*

CS1-Mg1

#### **4.4.4.4 Theme 4: Understanding**

With regards to this theme, a Problem-Based Learning (PBL) approach is supposed to be the first approach that needs to be used by the lecturer for the first year students, as described in section 4.2. The approach should only cover all semester 1 and semester 2 courses. However, findings shows that lecturers adopted the Problem-Based approach for all courses without proper understanding of the institute's requirements.

Responses from participants also indicated that some of the lecturers were unable to understand the approach itself. Thus, this situation has resulted in improper implementation.

*“Probably the concept is not being informed well. I think the Problem- Based concept is not well understood, well informed and well communicated.”*

CS1-Mg2

In terms of awareness of PBL implementation, a majority of the participants felt that they are doubtful that all staff in the institute are aware of the implementation of the AL within the institution. This is due to the possibility of insufficient information and explanation given to the staff, especially to the new staff.

*“There is also another issue here because, those coming in, I don't think there is comprehensive explanation about this institute's philosophy. They just get it from colleagues and friends like that. There is nothing so far.”*

CS1-Mg3

#### 4.4.4.5 Theme 5: Communication

From the interview, findings also found that 'communication' is another new theme highlighted by the management team which is crucial in preparing the staff. With regards to this finding, one participant highlighted that involvement from all levels within the institute is important, since through proper communication among all staff, the target can be achieved if everybody within the institute is moving in the same direction.

*“Together means from management top down and at the same time from staff to bottom up direction. We need to meet somewhere in the middle.”*

CS1-Mg4

Apart from proper guidelines or a framework that supports communication, the staff also required a proper platform as a way of communicating internally. Thus, these factors will enhance better communication in determining the staff preparedness for the AL implementation. In addition to this, the institute also should get involved in a relevant community and develop necessary networking which indirectly prepares the staff better.

#### 4.4.4.6 Theme 6: Learning Culture

The interviews revealed similar concerns raised by the staff, as discussed in 4.3.4.7. Most participants believed that the teacher-centred education system was experienced by a majority and the staff as well as the students identified it as one of the barriers to changing to a new approach.

On the other hand, one of the management added that the implementation of AL can be achieved by cultivating culture internally. Thus, he suggested that the use of staff appraisals, by setting a 'key performance index' ('KPI), will make the AL implementation a mandatory approach within the institute.

*“Culture can be overcome if KPI is set.”*

CS1-Mg3

#### **4.4.4.7 Theme 7: Facilities**

In answering concerns about facilities raised by many staff, a majority of the management team highlighted that they had tried their best to provide basic facilities during the initial stage in order to run the AL approach. One of the participants also added that the facilities will improve as years goes by and the institute is still trying to provide better facilities for their staff and students.

*“I think we are getting better in term of infrastructure. Maybe it will need another two or three years to get ready. In term of resources, the library is getting better now. We have ordered many books including books regarding PBL. So, I think it will be better in the future. I think for now infrastructure is going to that direction. So, I think it's not going to be a problem.”*

CS1-Mg4

#### **4.4.4.8 Theme 8: Attitude**

Findings from this theme highlighted that the management side agreed that the staff attitude plays an important factor that affects the staff preparedness as in 4.3.4.4. A positive attitude, passion, independence and the ability to work in a team are among the qualities that most staff should possess.

*“So actually it reflects to the teacher's attitude.”*

CS1-Mg4

#### **4.4.5 PBL Institute - Challenges Faced by Staff from Management's Perspective**

With regards to the challenges faced by the staff to employ PBL within the institute, each participant expressed different opinions regarding this issue. Figure 4.17 shows the challenge faced by the staff during PBL implementation from their point of view.

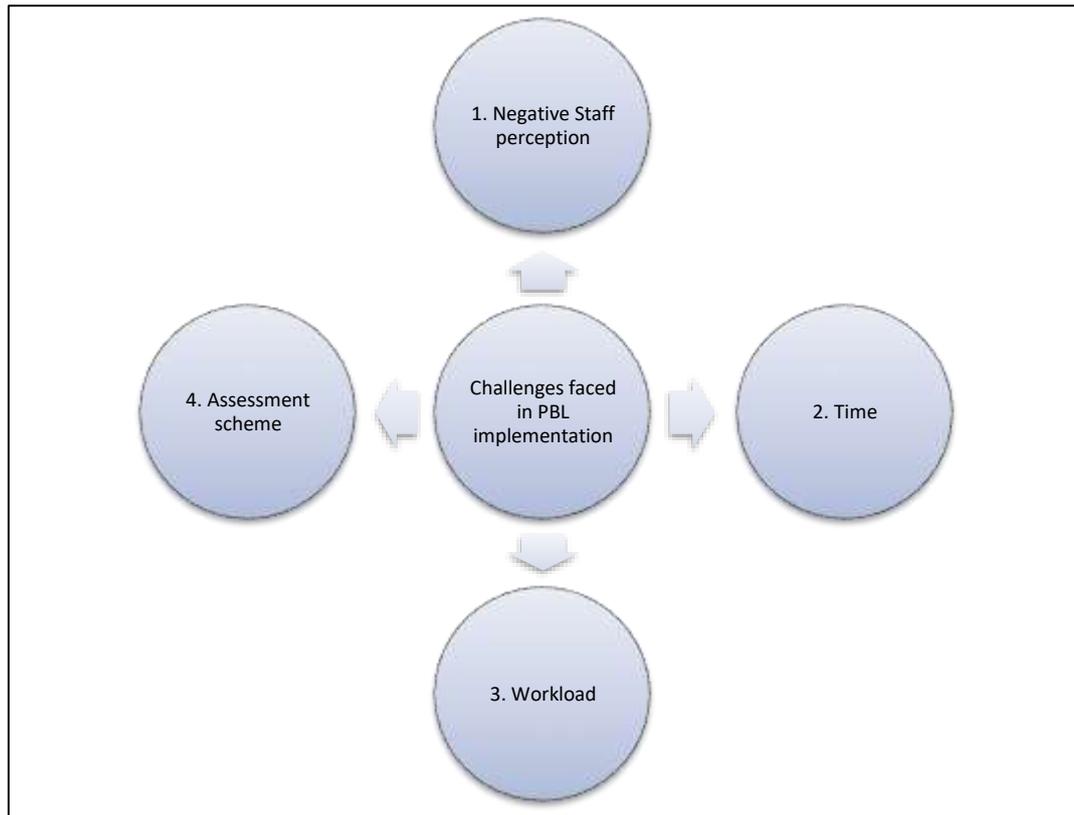


Figure 4.17: Challenges Faced by Staff from The Management’s Perspective

#### 4.4.5.1 Negative staff perception

With regards to PBL implementation, one of the HODs highlighted that PBL was hardly implemented due to the staff themselves as they do not believe in the approach taken.

*“The only challenge that we have at that time were the staff as they are a bit sceptical.”*

CS1-Mg2

#### 4.4.5.2 Time

Meanwhile, two other participants highlighted that the main challenge that the staff face in implementing PBL is to complete the syllabus within the limited time given during the semester. At the same time, the staff are also required to implement PBL during the class which according to them will take a longer time.

*“Since we want to use PBL approach, that is where the TTO facing a problem. To be honest, they don't have enough time at current situation. They take an effort to have extra class and time to finish everything. So we have to follow the requirement given by them as well as to use PBL approach for the module. That is the challenge actually.”*

CS1-Mg1

#### **4.4.5.3 Workload**

With regards to this issue, the management also agree that some lecturers are facing an excessive workload which indirectly discourages the staff to employ PBL in their class.

*“I think the answer is to re-structure the workload for staff. It is impossible for staff to have up to 40hrs teaching class and then ask them to do PBL. It is impossible.”*

CS1-Mg4

#### **4.4.5.4 Improper assessment**

One of the other main issues highlighted by the HODs is availability of proper assessment for the implementation.

*“We have training on what kind of question that we should have for PBL, it is called problem crafting but the problem now is we don't have training for proper assessment.”*

CS1-Mg1

#### **4.4.6 PBL Institute - Suggestions for Improvement by management**

With regards to the improvements that can be done to enhance the staff preparedness, the majority of the management highlighted that a proper reward system should be established in order to attract the staff to get involved in the AL implementation seriously. Apart from just giving a normal incentive, a proper reward system can be offered, such as offering training in other countries, a better remuneration scheme as well as a better career development system.

#### 4.4.7 PBL Institute - Summary of Managements' Perspective in PBL Implementation.

In summary, findings for this section is summarised in Table 4.7 which reveals how the management responded with regards to the staff preparedness in PBL implementation within the institute.

Table 4.7: Summary of Management's Perspective within the PBL environment

	Description	Staff' Practice and Experience
AL Awareness	AL approach	PBL
	AL starts	Since 2010
	AL adoption	All subject for 1 <sup>st</sup> semester
	AL venue	Classroom
	AL implementation	- individual initiative - based on individual interpretive
AL Practice & Implementation	Student's learning style	Problem solving
	Written guideline	No
	Institution supervision	No

In general, most of the management at first believed that the staff managed to implement the new approach introduced at the initial stage. However, as the implementation shows, differing approaches among staff caused various problems, this situation indirectly revealed that the staff were not able to perform the AL approach as expected. Table 4.8 summarises the Management's perception on the staff preparedness based on finding themes. Table 4.9 then outlines the challenges faced by the staff with regards to PBL implementation from the management's perspective.

Table 4.8: Summary Of Management’s Perception On The Staff Preparedness Based on Finding Themes

<b>Theme</b>	<b>Description</b>
Training	<ul style="list-style-type: none"> <li>- Only for selected staff only</li> <li>- No proper planning for training</li> </ul>
Leadership	<ul style="list-style-type: none"> <li>- Absent of leader</li> <li>- No monitoring</li> </ul>
Planning	<ul style="list-style-type: none"> <li>- Ad-hock implementation</li> </ul>
Understanding	<ul style="list-style-type: none"> <li>- Confusion over definition of Problem-Based Learning</li> <li>- Not clear on adoption</li> </ul>
Communication	<ul style="list-style-type: none"> <li>- No proper platform for discussion</li> </ul>
Learning culture	<ul style="list-style-type: none"> <li>- Influence from previous learning culture</li> </ul>
Facilities	<ul style="list-style-type: none"> <li>- Insufficient facilities available</li> </ul>
Staff Attitude	<ul style="list-style-type: none"> <li>- Negative perception</li> <li>- Rejection from staff</li> </ul>

Table 4.9: Summary of Challenges in PBL Implementation from Management’s Perspective

<b>Challenges</b>	<b>Description</b>
Staff Perception	Negative
Time	Too many syllabus to cover within time frame
Assessment	<ul style="list-style-type: none"> <li>- Not available</li> <li>- Not standardise</li> </ul>
Workload	High

#### 4.5 Students' Perspective in PBL Implementation: Students' Experience

This section presents the results from focus groups with the students. In general, the students selected have experienced the PBL approach within the institute. In doing the focus group interview, a total of eight groups of five participants were involved on a voluntary basis for each session. Results from the findings are to further understand the actual scenario by looking at their experience as well as their perception of PBL implementation. In addition to this, the findings will triangulate the results from sections 4.3 & 4.4. The semi-structured questionnaire that guides this focus group interview is attached in Appendix 19.

##### 4.5.1 PBL Institute - Students' background and demographic data

Table 4.10 provides a brief description of each group's background that was involved in the focus group interview. Pseudonyms were given to all participants for reasons of confidentiality and details of each participant were only known by the researcher. The identification used for the focus group participant is as shown. The groups' identification number was based on which semester the students were in, based at the time the study was conducted.

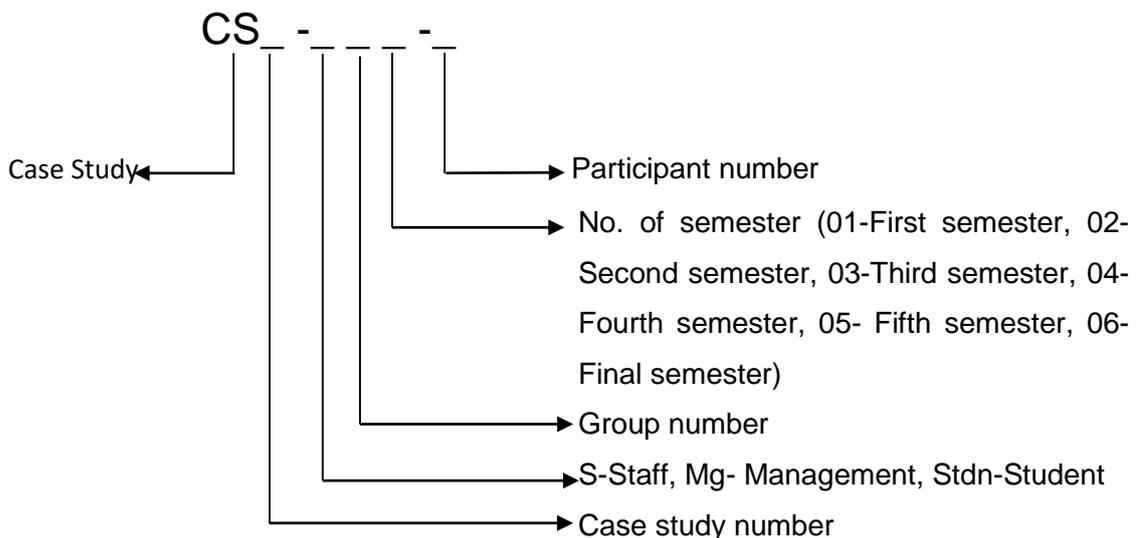


Table 4.10: PBL Institute – Participant’s Background For Student

<b>Group</b>	<b>Group background</b>
1. CS1-Std103	Third semester students that enrolled in PBL institute under new course and experienced PBL activity before
2. CS1-Std203	Third semester students that enrolled in PBL institute and experienced PBL activity before.
3. CS1-Std301	Newly enrolled students that experience PBL activity for the first time.
4. CS1-Std403	Third semester students that enrolled in PBL institute and experienced PBL activity before.
5. CS1-Std 504	Fourth semester group of students that enrolled in PBL institute under special course that allowed them to further their study in overseas. These groups of students are mainly from outstanding students.
6. CS1-Std602	Second semester students that enrolled in PBL institute under special course and experienced PBL activity before.
7. CS1-Std702	Second semester students that enrolled in PBL institute and experienced PBL activity before.
8. CS1-Std802	Second semester students that enrolled in PBL institute under special course and experienced PBL activity before

#### **4.5.2 PBL Institute - Students’ perceptions of AL implementation**

Findings from this sub-section seek to understand the students’ experience in PBL implementation. As the students are the ‘end-user’ of this approach, their involvement and experience in PBL implementation are vital in order to understand more about staff preparedness. Thus, results from this finding is important in order to reflect the actual condition of PBL adoption within the institute.

Across many focus groups, responses from participants reveal a mixture of feelings regarding PBL implementation. The majority of participants reported negative experiences while a number of respondents provided positive reactions upon implementation. From the findings, most participants revealed that they experienced a PBL approach for the first time in the PBL institute. The majority of responders also disclosed that they had never heard about PBL before.

With regards to participants’ understanding of PBL, many mentioned that they do not understand PBL clearly, regarding PBL activity as “a problem that needs to be solved”. Findings also reveal that most students believe that PBL is a task that needs to be completed by delivering a presentation.

*“Sometimes the lecturer will give us some task and we need to do some presentation. So normally we will assume that is PBL”*

CS1-Std504-4

Some participants highlighted that it is hard for them to understand what PBL actually constitutes. In addition, some responders also disclosed that PBL is a boring approach and they are not interested in doing PBL in the class.

Further findings from across the focus groups conducted revealed that PBL used for engineering subjects also includes some practical activities during the learning process. Hence, improper implementation has engendered negative perceptions from the students, as some of the lecturers simply used ‘PBL’ just to perform the practical activities.

*“We just follow the instructions learnt in the syllabus, set our practical based on our practical book. So nothing to do about PBL actually. It's just from secondary source.”*

CS1-Std802-4

In addition to that, a few participants also revealed that some of the lecturers also do not want to implement PBL in the class. Hence, this situation has obstructed the implementation required by the institute.

*“In fact, there was a case when the lecturer ask us whether we want to do PBL or not. So, some student choose not to do PBL.”*

CS1-Std103-1

Nevertheless, some responses across focus groups indicated positive experiences during PBL implementation; other respondents believed PBL implementation encouraged them to be independent, develop critical thinking, solve problems and to practise speaking in public.

*“I think it (PBL) is good because if I compare myself to other friends that do a degree, it's hard for them to explain even simple electric theory.”*

CS1-Std702-1

#### **4.5.3 PBL Institute - Students' perceptions of staff preparedness**

With regards to the staff preparedness, findings across the focus groups revealed that the staff preparedness varied based on the subject taught by the staff.

*“Some are ready but some are not.”*

CS1-Std403-4

Detailed responses from participants also highlighted that the students were also not sure how prepared the staff were, as they themselves are not sure how PBL approach is supposed to be conducted and how the staff should respond to the requirements.

*“If we know that is PBL, we can explain to you what is PBL. But we also not sure what is PBL.”*

CS1-Std301-5

#### **4.5.4 PBL Institute - The finding themes from students' perspective**

Findings in this section revealed five main themes derived from the focus group interview. In general, most of the themes are found to be similar to the themes discussed in sections 4.3.4 and 4.4.4. Only one new theme was observed, which is 'facilitation', as highlighted in Figure 4.18. Detailed information with regards to findings from the thematic network analysis are as per Appendix 20.

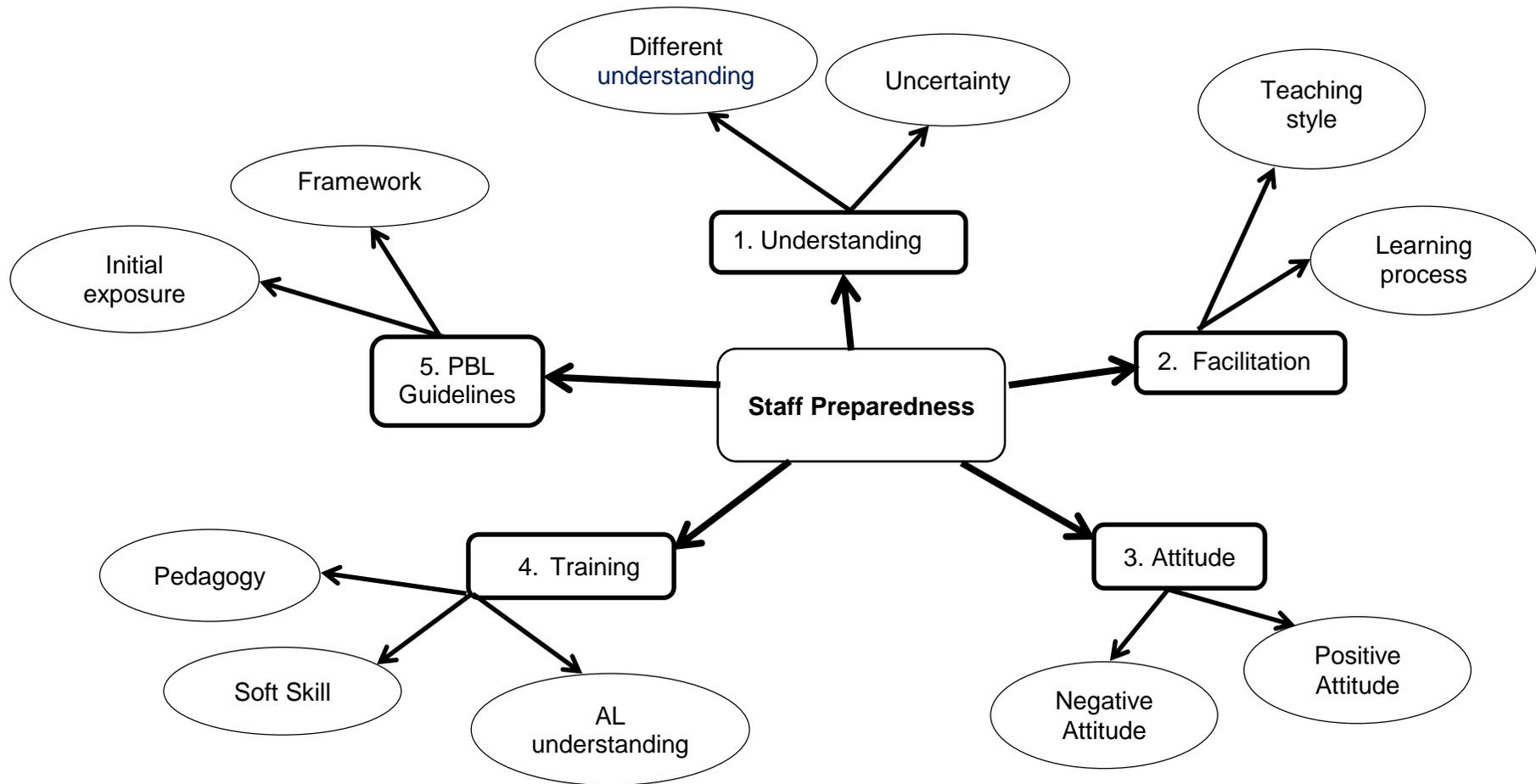


Figure 4.18: PBL Institute - Five Main Themes Emerge on the Staff Preparedness Based from Students' Perspective

#### 4.5.4.1 Understanding

Findings across the focus groups reveal that the staff's understanding of the PBL approach varies. Thus, most participants highlighted that PBL implementation is run differently based on the subject taught, as well as the staff member's individual style. While PBL uses problems to initiate the learning process, feedback from participants revealed that some PBL activities conducted by certain staff were similar to normal exercises.

*“But some lecturer did give some sort of assignment but they said that is PBL. But actually it is not a PBL because we don't have the 3k's”.*

CS1-Std403-5

In addition, further findings demonstrated that PBL implementation is sometimes based on individual interpretation, either as an approach or just simply when completing an assignment.

#### 4.5.4.2 Facilitation

The focus groups revealed how the students struggled during the PBL learning process in class. A majority of the students expressed dissatisfaction with how the staff reacted during PBL sessions. One response highlighted that the staff do not 'help' the students to solve the PBL task, with most lecturers expecting the students to complete the task by themselves.

*“They need to give us more guidance”*

CS1-Std203-2

Participants across the group also expressed concern because some of the lecturers failed to provide necessary responses with regards to the PBL given. In other words, no reflective or review session was conducted following the PBL task.

*“The lecturer didn't do any feedback or review on what we are supposed to understand on that chapter”*

CS1-Std103-3

#### **4.5.4.3 Staff Attitude**

Findings across the focus groups reveal that staff attitudes play an important role in PBL implementation. Lecturers who have more teaching experience are generally more prepared compared to the new staff, and their positive attitude also plays a major role in enhancing their performance. However, some participants also spoke of a case where senior staff refused to implement PBL even when it was a requirement for the course taken.

Some staff occasionally reacted negatively towards the students which had caused the students to become scared of them. Thus, this negative attitude has caused the students not to participate effectively during the PBL session.

#### **4.5.4.4 Training**

In terms of training, feedback across the focus group highlighted that most of the staff required more training to improve their teaching skills. Apart from lacking a proper understanding of the AL used, findings also revealed that some of the staff were required to improve their communication skills, which is also likely to improve their teaching. In addition, some of the responses also highlighted that the staff should possess the necessary skills to make the learning and teaching effective.

*“They need to improve their teaching skill in order to attract students to learn.”*

CS1-Std203-4

#### **4.5.4.5 PBL Guidelines**

Findings across the focus groups also reveal that the staff should provide necessary guidelines for the PBL in each course. The guidelines should include necessary information that helps both students as well as the staff to implement PBL correctly. Hence, this guideline can be a minimum reference on how the PBL should be conducted by both parties.

*“If they can provide a guideline, then we know what to do.”*

CS1-Std602-4

#### 4.5.5 PBL Institute - Challenges faced by students in PBL Implementation

Findings in this sub-section explore the challenges faced by students with regard to PBL implementation. In addition to this, the questions posed also uncovers any findings that relate to the staff preparedness from the students' perception. Figure 4.19 shows the challenges faced by the students during PBL implementation.

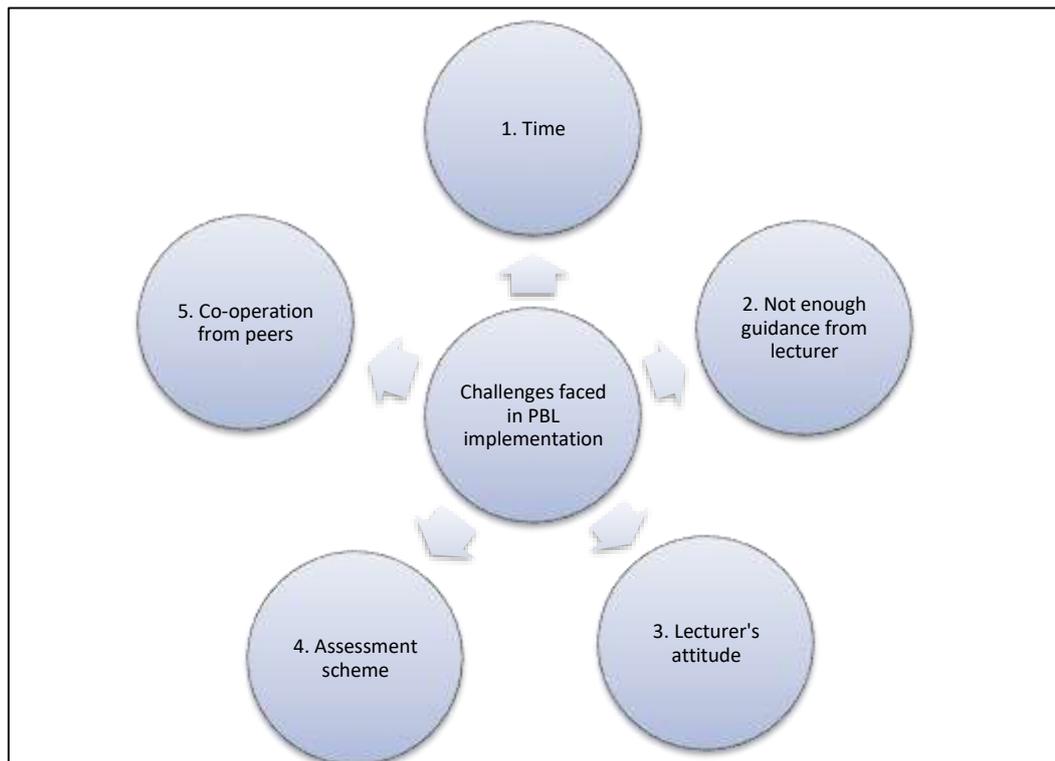


Figure 4.19: Challenges Faced by Students in PBL Implementation

##### 4.5.5.1 Time

Across many focus groups, most participants highlighted that time limitations are one of the biggest challenges that they have to face during PBL implementation. This is due to the fact that some subjects contain too much in the syllabus to cover completely, which reduces the time allocated for the PBL activity in class.

Some participants added that they have too many other PBL tasks given in other subjects to complete.

*“Sometimes quite a number (PBL) to solve at one time.”*

CS1-Std403-4

#### **4.5.5.2 Not enough guidance from lecturers**

A majority of respondents highlighted that they are having difficulties in completing the tasks given during PBL sessions. According to the findings, some lecturers simply let the students do the PBL by themselves without proper facilitation and guidance.

Findings also reveal that some of the lecturers are not even ready for the class.

*“In doing some exercises, I think sometimes they themselves don’t know what they are doing. They just give the answer from the answer scheme without understanding about it.”*

CS1-Std702-4

#### **4.5.5.3 Lecturers’ attitude**

Findings across the focus groups demonstrate that some lecturers possess a negative attitude when handling classes. Other respondents also commented that some of the lecturers are not willing to help them in the class during PBL sessions. In addition, some of the lecturers are hard to contact outside the class if students require any additional information.

*“Sometimes they say we can see them if we don’t understand but when we go and see them, sometimes we get scolded. So actually we are scared of them.”*

CS1-Std103-2

#### **4.5.5.4 Assessment scheme**

One of the issues raised by respondents across the focus groups is inappropriate assessment given for the PBL approach; students were concerned about the improper marking scheme allocated for PBL activity as it required a lot of work to be done.

*“In terms of marking, we also not sure about this. For example, the subject X, we don’t know how the marks being given.”*

CS1-Std702-4

In addition to this, a shocking finding uncovered that a few lecturers just simply used other means of assessment to replace PBL assessment.

*“There was a case where the mark allocation is meant for PBL but we were given a Quiz to answer. So we got quite a low mark on that and we were quite surprise. We did ask question on this because we never do any PBL for the subject. “*

CS1-Std403-5

#### **4.5.5.5 Co-operation from peers**

One of the challenges raised across the focus groups is to get full co-operation among peers, as not all group members contribute to the PBL activity. Findings also reveal that some of them are lazy but they were given equal marks towards the end. Thus, this situation had triggered dissatisfaction among other group members.

*“I can see that some of my friends do not give co-operation because sometimes I feel like I do the work alone and the rest just being a 'passenger' in the group”*

CS1-Std103-3

#### **4.5.6 PBL Institute - Suggestion for improvement from students'**

Figure 4.20 summarises the suggestions across the focus groups. The findings discuss some suggestions for further improvement.

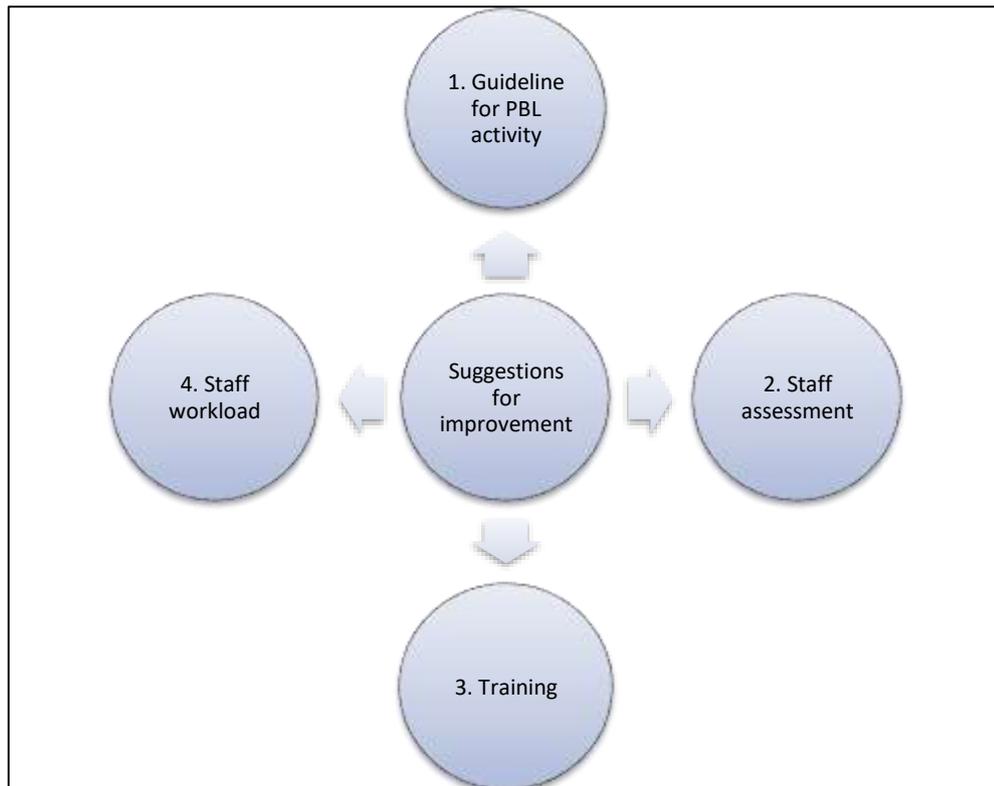


Figure 4.20: PBL Institute - Suggestions for improvement from Students Perspective

#### 4.5.6.1 Guidelines for PBL activity

Findings across the focus groups suggested guidelines on the PBL activity would be very helpful. These guidelines should include how to implement proper PBL activities which should reflect the staff as well as the students. In addition, it is also necessary to make sure that the guidelines are well-known by related parties.

*“If they can provide a guideline, then we know what to do.”*

CS1-Stdn602-4

#### 4.5.6.2 Staff assessment

Findings also suggested that it is necessary for the lecturer to be assessed in order for them to implement PBL. This is to make sure that they understand the approach used as well as being capable to implement the approach as required. Participants also highlighted that the lecturer should possess the necessary experience

in relevant areas, particularly from industry which would help them to implement a better AL approach.

*“Assessment on them (lecturer)”*

CS1-Std802-4

#### **4.5.6.3 Training**

With regards to this suggestion, findings across the focus groups suggested that training should be required by the staff in order to implement PBL effectively. Some participants also highlighted that most of the lecturers should improve their teaching and communication skills.

*“Some yes, certain don’t know. They need more training.”*

CS1-Std802-4

#### **4.5.6.4 Staff workload**

Responses from participants also reveal that some of the lecturers are having too many classes, and their workload is difficult to handle. This condition has reduced their capacity to perform well as they cannot focus on each session. In addition, the situation has reduced the staff’s concentration, especially when long contact hours are involved.

*“I noticed that this lecturer is handling too many classes. So sometimes she felt confused between the classes. For example she said she already explained in the class but actually she didn’t.”*

CS1-Std301-2

#### **4.5.7 Summary of Students’ Perspective in PBL Implementation**

As the students are the user that deal with the AL adoption, their experience with the staff is critical to the actual implementation. Table 4.11 summarises the findings from students’ perspective with regards to PBL implementation. Findings in this sub-section reveals that the staff preparedness varies according to the individual as highlighted based on the themes derived as shown in Table 4.12. In addition, Table 4.13 lists out the challenges that they face during PBL implementation.

Table 4.11: Summary of Students' Experience in PBL Environment

	Description	Staff' Practice and Experience
AL Awareness	AL adoption	Certain subject
	AL venue	Classroom
	AL implementation	- individual initiative - based on individual interpretive
Experience in AL implementation	Previous AL experience	None
	AL training	1 day (during induction)
	Written guideline	No

Table 4.12: Summary of Student's Perception on the staff Preparedness Based on Finding Themes

Theme	Description
Understanding	- based on individual interpretation - resulting confusion over PBL adoption
Facilitation	- lack of supervision and guidance given - students required to complete the task by themselves
Staff Attitude	- based on staff initiative and style - Staff who possess positive attitude manage to adopt the AL positively
Training	- Teaching skill - communication skill
PBL Guidelines	- No

Table 4.13: Summary of Challenges Face by Students In PBL Implementation

Challenges	Description
Limited Time	Yes
Guidance from Lecturer	No
Lecturer's Attitude	Mainly negative
Assessment	- Not clear - Not standardise - Improper marking scheme
Co-operation from peers	No

#### **4.6 Conclusion for Case Study 1**

In conclusion, findings from Case Study 1 concludes that the staff preparedness in implementing AL in PBL Institute varies among staff and the implementation is done based on individual initiative. Thus, there is no consistency to be found. Findings from the interviews with management and students support the results as there is convergence in the themes that emerge. Thus, further analysis on the findings is expected to reveal the actual problems that arise.

The following chapter will present findings from a second case study conducted for this research work.

## **CHAPTER 5 : QUALITATIVE FINDINGS CASE STUDY 2 – WBL INSTITUTE**

### **5.1 Introduction**

This chapter presents the findings obtained from a second case study conducted in Malaysia that observed another AL implementation by WBL Institute. Semi-structured interview questions were again given to participants; however, some modifications were made to the questions in order to suit the AL adopted by the institute. In order to achieve a better understanding of the research work undertaken, the layout of this chapter is arranged in a similar way to Chapter 4, which also explores the perceptions of staff, management and students. Findings from this second case study start by providing a brief background to WBL Institute, followed by sub-sections that consist of findings from the three different stakeholders. Subsequently, each sub-section will present demographic data on the participants before presenting the participants' perceptions of the AL that they adopted, as well as the themes emerging from the findings. Further results also highlight the challenges and limitations faced by participants in the approach used.

### **5.2 Background of WBL Institute**

WBL Institute is located close to the Malaysian capital of Kuala Lumpur. The Institute was certified with MS ISO 9001:2000 in 2002 which aligned with their aim of offering high-quality courses by their well-trained and professional staff. Starting in 2010, one of the engineering courses offered by the institute has adopted Work-Based Learning (WBL) approach, which combines classroom instructions with structured real-life work experience in order to prepare students for a competitive workplace. Ultimately, the purpose of this program is to provide the best education and training for students in order to meet their current career demands.

In the WBL curriculum, students are required to complete a two-years program in which the first takes place at their respective institutions, followed by another year in a relevant industry. During the latter period, students will be equipped with up-to-date knowledge and skills as a result of on-site training. This collaborative programme is conducted in partnership with one of the well-known local companies.

Thus, it is important to understand that WBL implementation is not done in an academic environment in year 2, but in an actual working environment. Hence, for this case study, the interviews were carried out at a few different sites allocated to students for their WBL activity.

Figure 5.1 shows the hierarchy and sites of WBL implementation.

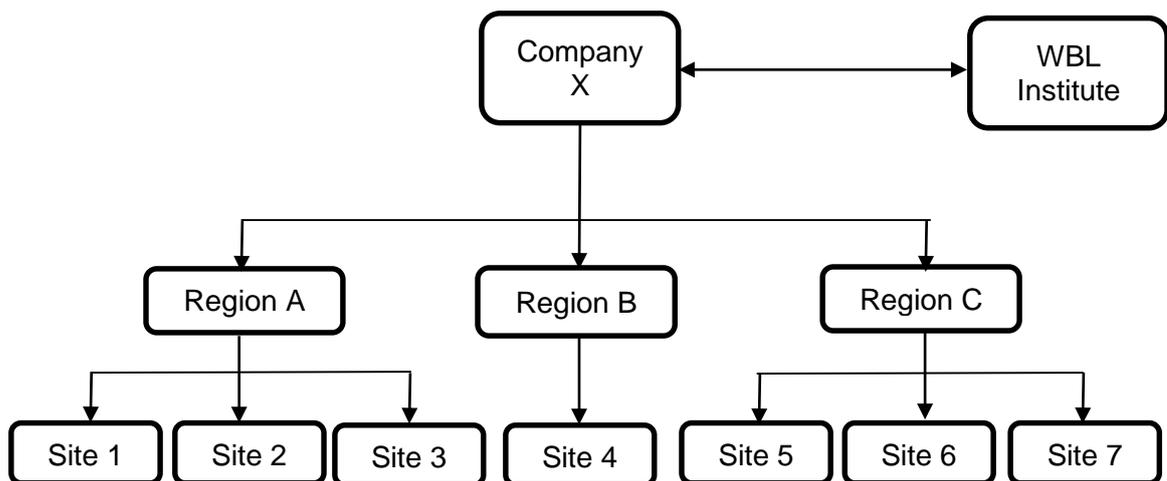


Figure 5.1: Hierarchy and sites of WBL implementation

### 5.3 Staff Perspective in WBL Implementation: The Mentoring Experience

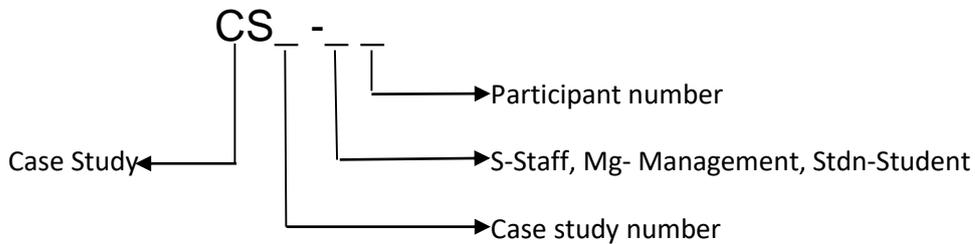
In this section, data was taken from semi-structured interviews with some staff (known as a 'mentor') who are involved in the WBL implementation. With regards to WBL approach, the learning process mostly happens within two activities, either during machine breakdown (MB) or planned preventive maintenance (PPM). In WBL process, the students are required to learn specific equipment as stated in the syllabus under the guidance from mentor.

In general, these mentors are mainly technical staff who are working with Company X to which the WBL students were attached (refer to Figure 5.1). 17 mentors were recorded participating in this study and located at 7 sites (hospital). As the WBL program is undertaken on actual premises, all research work was required to follow necessary rules and regulations prior to data collection. Again, the participants' involvement was carried out on a volunteer basis.

The first part of this sub-section offers a brief summary of participants' demographic information, including their educational background as well as work experience. The findings start by exploring the participants' perception of the WBL implementation, followed by presenting the findings themes with regards to staff preparedness. Issues like challenges and obstacles faced by the participants are also illustrated in the next sub-section.

### 5.3.1 WBL Institute – Mentors' Background and Demographic Data

This sub-section describes a brief description of the participants' background. Pseudonyms were given to all participants in the interests of confidentiality. The names given are based on the code below and only recognised by the researcher.



Demographic details of the participants can be seen in Table 5.1, and the summaries of participants' profiles are shown in Figures 5.2 and 5.3.

Table 5.1: Mentors' Profile and Background

Name	Highest education level	Working experience (years)			Involvement in WBL	Remark
		Before	Current company	Total		
1. CS2-S1	HND in Medical Electronic	0	11	11	2012	
2. CS2-S2	Certificate in Electronic Communication	8	14	22	2012	
3. CS2-S3	Diploma in Electrical Engineering	17	8	25	2010	
4. CS 2-S4	Degree in Medical Electronic	0.5	2	2.5	2013	
5. CS 2-S5	Degree in Biomedical Engineering	0	0.25	0.25	2014	Part-time tuition teacher
6. CS2-S6	Post Diploma in Biomedical Engineering	8	11	19	2012	Expatriate from India

7. CS2-S7	Degree in Electric Electronic	0	15	15	2013	
8. CS2-S8	Diploma in Medical Electronic	0	10	10	2013	
9. CS2-S9	Diploma in Electric Electronic	10	14	24	2012	
10. CS2-S10	Diploma in Mechatronic	4	5	9	2012	
11. CS2-S11	Advance Diploma in Medical Electronic	0.5	4	4.5	2010	Ex-WBL student
12. CS2-S12	Diploma in Electric Power	2	17	19	2012	
13. CS2-S13	Advance Diploma in Instrumentation	17	17	34	2010	Part-time lecturer
14. CS2-S14	Degree in Medical Electronic	2	2	4	2012	
15. CS2-S15	Diploma in Mechatronic	3	4	7	2012	Part-time student
16. CS2-S16	Degree in Electric Power	5	16	21	2012	Part-time lecturer
17. CS2-S17	Diploma in Electric Electronic	14	6	20	2012	

With regards to mentors' educational background, most of the participants hold at least one Diploma in a related discipline except one participant who just has a Certificate qualification. However, his involvement in WBL as a mentor is justified, since he has more than 22 years' experience. In addition, findings also show that a majority of the staff who possess qualifications below Diploma level are senior staff who have been working for around 20 years or more with the company. Thus, their experience in the field compensates for the lack of qualifications.

Based on the demographic data, Figure 5.2 shows that more than half of the participants possess at least a Diploma as their 'highest level of education', while 1 staff member only possesses a Certificate.

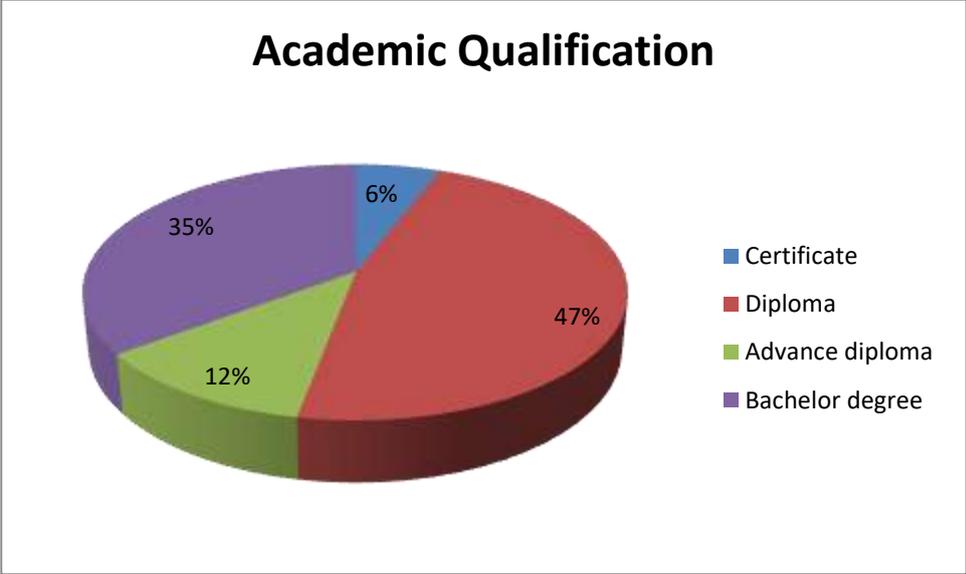


Figure 5.2: Mentors' Academic Qualifications

Figure 5.3 shows the work experience of the staff involved in the WBL approach. Detailed information from the demographic forms indicate that the participants range from fresh graduates through to those at senior level who have been working for more than 20 years. Generally, most of the participants involved in the WBL approach possess more than 5 years' experience of working in the industry and have acquired appropriate expertise in a related field.

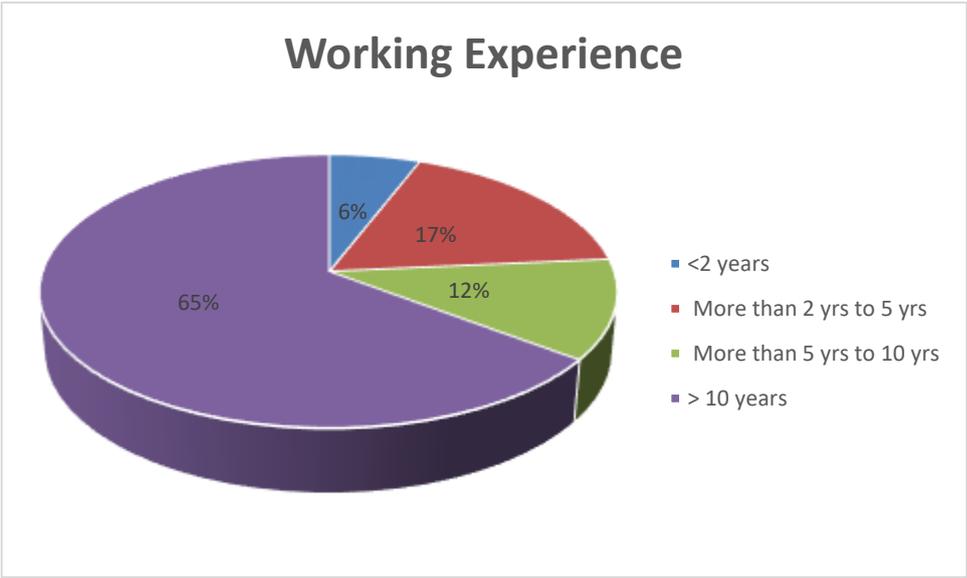


Figure 5.3: Mentors' Working Experience

### 5.3.2 WBL Institute – Mentors’ Perceptions of AL Implementation

When answering the first research question – ‘*What are the staff perceptions of Active Learning as an approach in engineering education?*’ – a majority of the participants provided a positive response to the implementation.

Results from the findings show that most of the participants support the implementation, as the approach manages to provide a good program that benefits the students.

*“It is a good step by the institute to have this program”*

CS2-S12

However, some of the participants raised concerns over the program as the implementation required an extra task to be done apart from their normal working job.

*“We are not only teaching them but we also need to concentrate others as well. So my other job will be affected as I'm doing WBL mentor.”*

CS2-S7

In addition, some participants revealed that the program has indirectly helped them to refresh their knowledge of their field. This is due to the fact that they are required to teach the students theory and technical information.

With regards to their awareness on the WBL approach, results show that the majority of the participants were aware that the WBL program is conducted at their premises. Responses from participants also reveal that the students are welcome and accepted by the team at their premises. However, a few participants revealed that they were not aware of the WBL program at first. In other words, some of the staff were not aware of the mentoring role that they were supposed to perform.

*“Actually I didn’t realise on this mentoring job.”*

CS2-S5

### **5.3.3 WBL Institute - Mentors' Perceptions of Preparedness**

With regards to their perception of preparedness, a majority of participants explained that they were prepared to deliver the approach at their premises as required.

*"I am a trainer here so I am already well-prepared and I like it as well."*

CS2-S13

However, some participants suggested that they were not sufficiently prepared to be a WBL mentor.

*"I don't think I am prepared well for this but, but I need to teach them for WBL."*

CS2-S10

### **5.3.4 WBL Institute - The Finding Themes from Mentors' Perspective**

From the interviews conducted, six themes emerged that reflect on the mentors' preparedness, as shown in Figure 5.4. The thematic network analysis was done as per Appendix 21.

The six themes found are related to the same sub-research question post as below:-

1. What are the factors that influence staff preparedness in AL implementation?
2. How staff are prepared towards the implementation of Active Learning?

Detailed findings from the interviews also revealed how WBL activity has actually been conducted, based on participants' experiences from the start. Thus, the results also indirectly disclosed how prepared are the mentors with regards to WBL adoption.

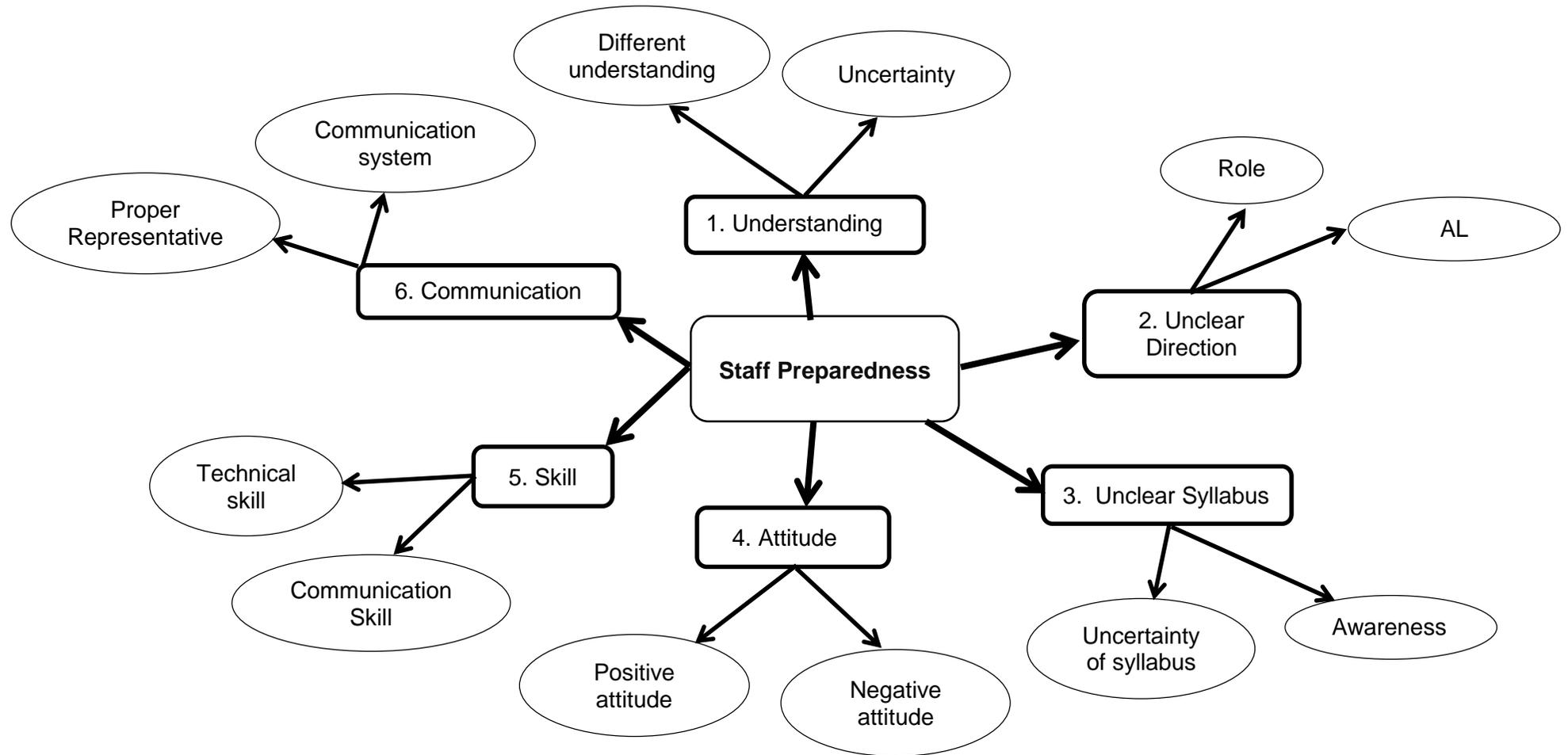


Figure 5.4: WBL Institute - Five Main Themes Emerge on the Mentors Preparedness based from Mentors' Perspective

### 5.3.4.1 Understanding

With regards to the staff preparedness, mentors' understanding of the approach used has led to an important finding, as it reflects how they perceive the task given to them. In other words, this theme refers to the participants' understanding of the concept of WBL that is employed within their premises. Two sub-themes have thus been identified, as Figure 5.5 demonstrates below.

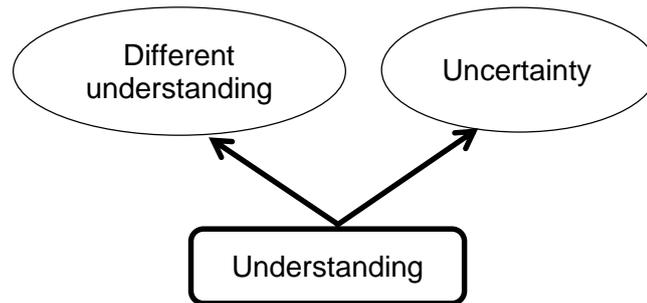


Figure 5.5: Mentor - Theme and Sub-themes for Understanding

In general, findings show that participants possess different levels of understanding with regards to a WBL approach, which are mainly based on their own interpretations. While some of the participants reveal that they do not possess a clear understanding of the approach used, a majority of the participants do acquire a good understanding of the WBL approach.

*“What I understand is learning while working.”*

CS2-S11

However, some responses from the participants indicate confusion and misunderstanding. For instance, some of the staff assume that WBL constitutes the same approach as the internship activity that was offered at their premises before.

*“Actually this WBL is almost the same like other student who came for practical. There is no difference in that. The only difference is the time allocated for them is longer as compared to normal practical which is just 6 months.”*

CS2-S1

### 5.3.4.2 Unclear Direction

Closely connected to the first finding theme, the mentors' understanding determines how the staff should react to the WBL approach. In other words, it requires the staff to have appropriate information about their role. Hence, participants who possess a good understanding of the WBL approach possess clear direction on the approach used. Subsequently, they are fully cognisant of their role as a mentor to the WBL students. This helps them to be prepared for the WBL activity.

With regards to this theme, two sub-themes have been identified as Figure 5.6 below shows.

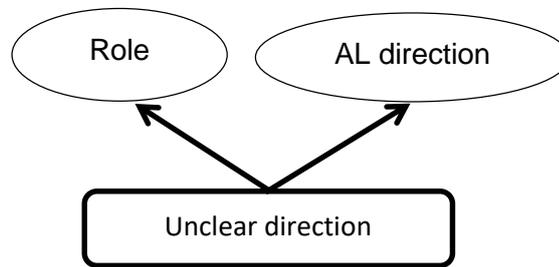


Figure 5.6: Mentor - Theme and - Sub-themes for Unclear Direction

While conducting mentoring tasks for the WBL program, a few participants revealed that they do not possess a clear enough grasp of the WBL programme. Hence, they are unsure how the WBL activity is supposed to be conducted throughout the session.

*“I hope to know what actually this WBL program is doing, what is their expectations and goals”*

CS2-S7

One participant also highlighted that they wanted to know detailed information on their task as a WBL mentor. Failing to receive necessary information, this situation has discouraged them from performing their role efficiently, as they are not sure of the direction of the programme.

*“For this WBL, they are here for almost a year. What should we do to them actually? We are not sure what should we provide to*

*make sure that the knowledge that they get is equal to their Advanced Diploma level.”*

CS2-S16

### 5.3.4.3 Unclear of WBL syllabus

With regards to performing their task as a mentor in WBL, it is understood that the staff are required to train the students based on the syllabus prepared for WBL tasks. In addition, there is a structured schedule prepared for the students in order to guide them on how WBL activity should be enacted throughout the process. In general, the schedule highlights the list of equipment that the students need to cover within the allocated time. The related equipment given are basically the ‘topics’ that these mentors should manage. Thus, as a mentor, they are required to provide some technical theory on selected equipment used, perform practical activities related to the equipment, and guide the students in maintenance and dealing with daily tasks.

Findings brought about two important sub-themes associated with an unclear syllabus, as shown in Figure 5.7 below.

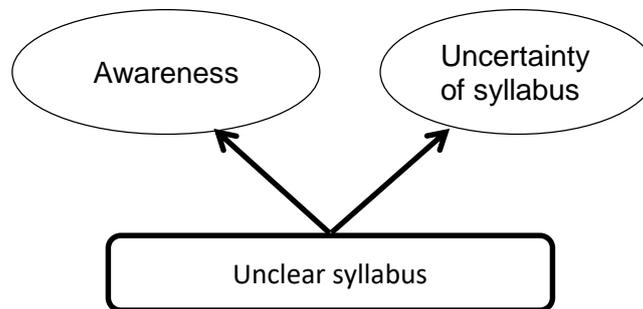


Figure 5.7: Mentor - Theme and Sub-themes for Unclear Syllabus

Responses from a majority of participants highlighted that they were not aware of the existence of a syllabus as well as general guidelines prepared specifically for the WBL program. Thus, findings show that the majority of the mentoring activity was done based on mentors’ daily tasks.

*“For example on the syllabus that needs to be covered, not all mentors are aware on this. Most of them just emphasise on practical and they explain less in theory”*

CS2-S11

There was also a concern with the syllabus outline as irrelevant content was included.

#### 5.3.4.4 Attitude

A majority of participants stipulated that the mentors' attitude played an important role in preparing them for the WBL approach. Two sub-themes were identified, as shown in Figure 5.8 below.

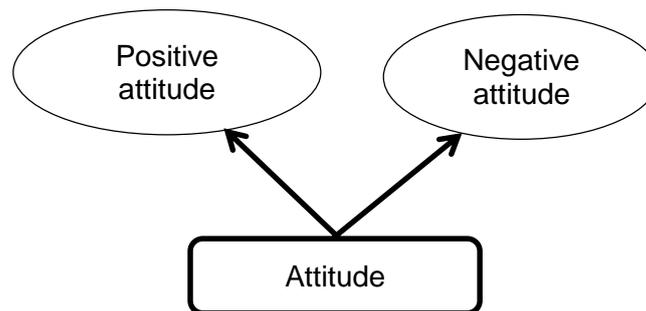


Figure 5.8: Mentor - Theme and - Sub-themes for Attitude

A majority of participants said that it is important for mentors to possess a positive attitude in order to be prepared. Several attitudes and characteristics of a good mentor were highlighted by participants, including diligence, confidence, passion, a willingness to share knowledge, and, most importantly, the willingness to be a 'teacher'.

However, findings revealed that some participants highlighted a negative attitude possessed by several staff members, which affected the mentoring sessions with students. These included negative perceptions of the students, as well as moodiness.

*"I think we should have a guideline to teach them and we also need to be willing to teach them at first. It's not that they were forced to teach them. For me, some people maybe don't like to share with others."*

CS2-S15

### 5.3.4.5 Skills

Since this AL approach was conducted in an actual working environment, it required mentors to possess the necessary skills to perform well in order to achieve the objective of WBL implementation. Three sub-themes that the mentor should possess were posited, as shown in Figure 5.9.

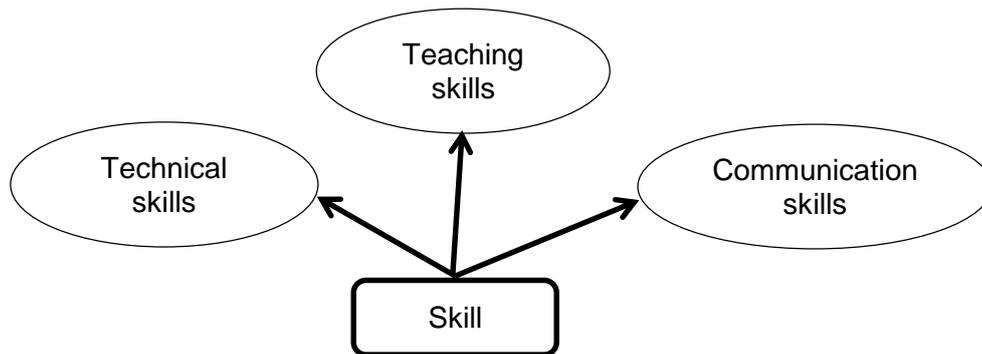


Figure 5.9: Mentor - Theme and Sub-themes for Skill

Findings from the interview reveal that the majority of participants highlighted that it is important for the mentor to possess good technical skills in order to qualify them for the role. Apart from having knowledge in a related field, technical skill is important in order to perform daily maintenance and repairs, as well as to provide necessary guidance and coaching to the students.

It was also considered important for them to have necessary teaching skills, especially for WBL activity.

*“We appoint mentor by their speciality or their experience, but they don't have teaching skill. So, I think management need to have a program to make sure that these mentors have appropriate teaching skill especially to teach the students.”*

CS2-S8

Other participants suggested that mentors should possess good communication skills. This includes the ability of mentors to communicate in English as most of the training material and machine manuals are in English.

### 5.3.4.6 Communication

From the findings, another important theme highlighted by participants is having proper communication between all levels involved. Figure 5.10 shows two important sub-themes on this matter.

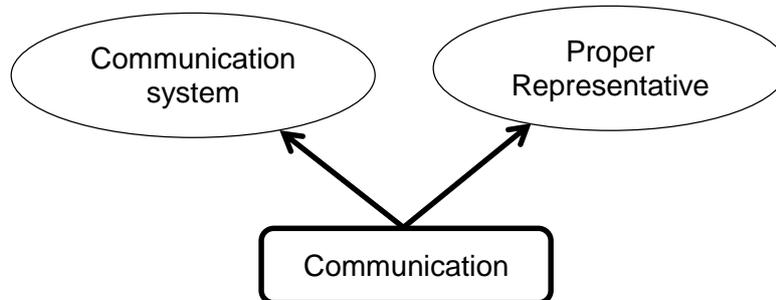


Figure 5.10: Mentor - Theme and Sub-themes for Communication

As WBL implementation requires involvement from different institutions, having proper communication is the key in order to prepare the staff for fulfilling their responsibilities as a mentor. This is to make sure that they are aware of any issue involved in WBL implementation.

Findings from the interview reveal that the communication conducted was based on the appointed representatives from each party at different levels. The use of electronic communication such as e-mail was found to be a common medium used in order to ease their workload.

*“Normally they will share the information through email and I don’t have any problem so far. The person in charge normally will update and inform us. So do our team leader here. He will update us with any related information.”*

CS2-S2

### 5.3.5 WBL Institute - Challenges Faced by Mentors In WBL Implementation

In answering the research question ‘*What are the challenges faced by the staff in implementing Active Learning?*’, findings in this section will reveal the obstacles that mentors face in implementing a WBL approach. Figure 5.11 illustrates the challenges highlighted by participants.

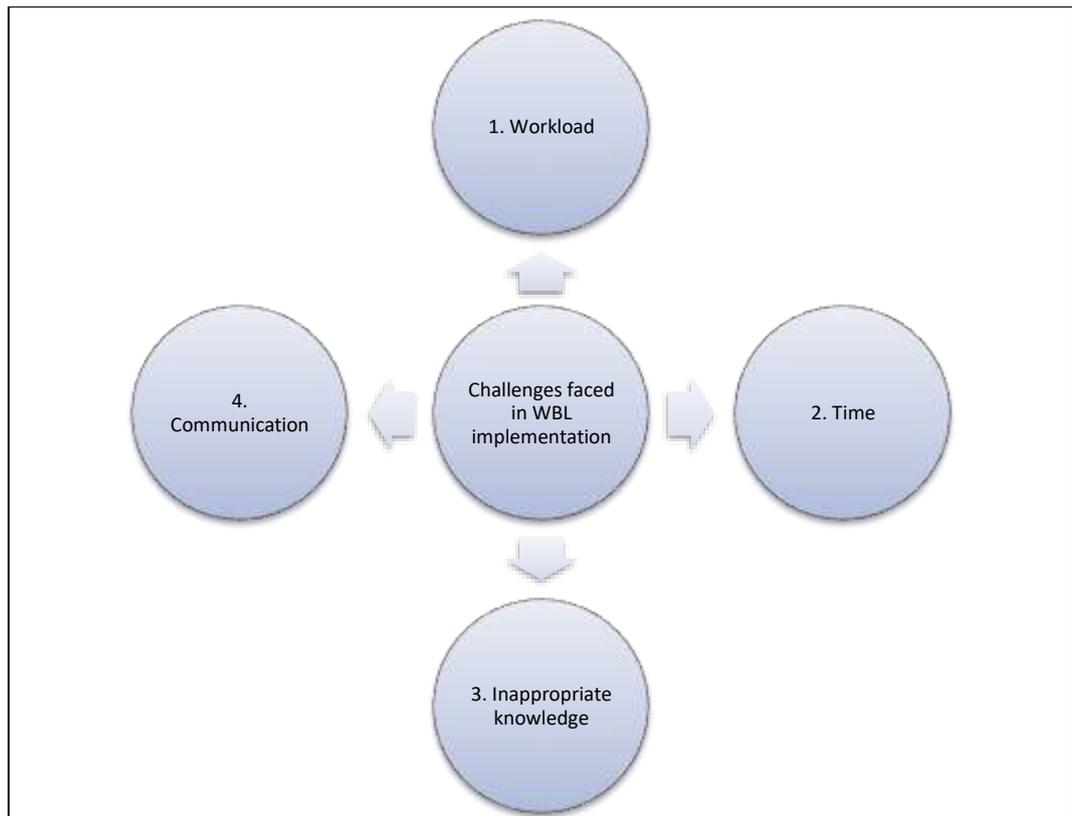


Figure 5.11: Challenges Faced by Mentor in WBL Implementation

### 5.3.5.1 Workload

Feedback from participants indicated that their daily job and responsibilities were demanding. Thus, the task of WBL mentoring caused additional workload in their daily routine.

*“We are not only teaching them but we also need to concentrate on other work as well. So my other job will be affected as I’m doing WBL mentor.”*

CS2-S7

In addition to that, some mentors also said that they cannot give full attention to WBL activities due to their job constraints.

*“I couldn’t fulfill it 100% because of the job constraint.”*

CS2-S3

### 5.2.5.2 Time

Feedback from participants also noted that time limitation is one of the challenges that the mentors face in order to deal with WBL activity. Hence, most of the mentors need to properly plan and manage their time well in order to perform their duties effectively.

*“When the WBL come in, we are a bit rushed and not well organised.”*

CS2-S7

Moreover, one of the participants also highlighted that some mentors are having difficulties in fulfilling their mentoring role owing to their daily routine, given that WBL students are only available during working hours. For instance, sometimes their job requires them to attend an emergency task during working hours and they are therefore only available after that. Thus, the situation causes inconvenience for them.

*“It is hard for us to concentrate on them. For example, equipment in the hospital is being used 24 hrs a day while students time is only limited during office hour”*

CS2-S8

Some of the mentors have requested a proper time allocation in order for them to have an appropriate mentoring session with the students. According to them, this time allocation should be arranged outside normal working hours so they can concentrate on theories.

### 5.3.5.3 Inappropriate Knowledge

One of the challenges that is also highlighted by the mentors is their lack of knowledge in their field. Thus, some of the mentors do not feel confident to teach, and convey their knowledge to the students.

*“I think it is very challenging because you need to gain more knowledge.”*

CS2-S13

One of the participants indicated that he lacks the knowledge of related theories. Thus, he stressed that the staff should be equipped with necessary knowledge before becoming a mentor. This concern was raised by some mentors who are not graduates or possess a related background in medical electronics. Thus, this situation has caused inconvenience to some people.

#### **5.3.5.4 Communication**

As communication plays an important role in WBL implementation, one participant highlighted that the use of a second language has become a barrier to communicate well with the students. This is due to the fact that as he was from India and he is unable to communicate in the local language, he prefers to use English instead.

*“My problem is maybe the language, which is difficult to overcome. I talk more in English but some of the students maybe not confident in the used of English.”*

CS2-S6

Similarly, another mentor highlighted that he was having difficulties in finding information as most of the sources and information are written in English.

*“For me I have weaknesses to communicate in English, because most of the manual for the machines are in English.”*

CS2-S2

Other mentors felt that the students were not able to communicate well enough in English, and this situation could hinder them in the future, especially when they are required to communicate effectively in a working environment.

*“..they need to do in English. So, I think they need to prepare for it. English language is important.”*

CS2-S13

### 5.3.6 WBL Institute - Suggestions for Improvement by Mentors

As most of the participants from the interview experienced positive feelings regarding WBL implementation, further findings in this section reveal some suggestions by the mentors for further improvement. Figure 5.12 depicts these suggestions.

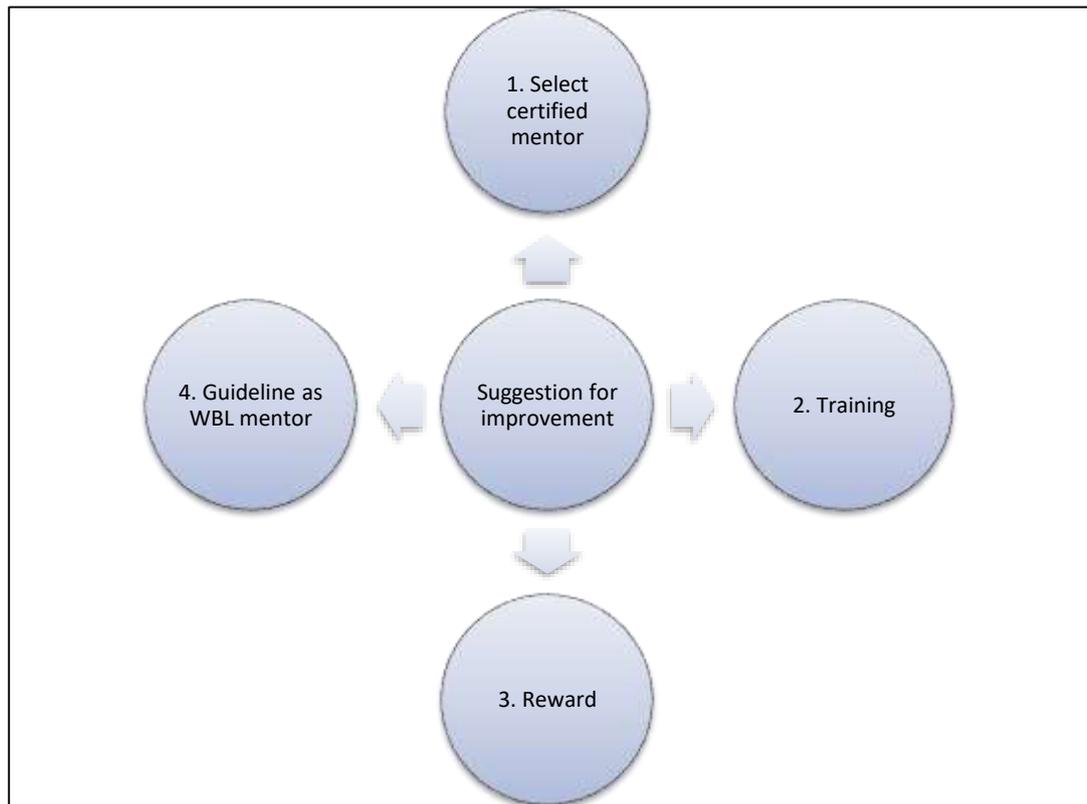


Figure 5.12: Suggestion for Improvement from Mentor

#### 5.3.6.1 Select Certified Mentor

Some participants suggested that it is important to select a proper mentor in order to have an effective mentoring system for the WBL activity. Thus, one of the suggestions highlighted by participants is to certify suitable staff to become proper mentors. This is due to the fact that not all the staff are willing to be, and capable of being, a mentor.

*“Sometimes maybe they were forced to be a mentor and they didn't perform well. So I think we need to find a suitable person for this.”*

CS2-S13

### 5.3.6.2 Training

In order to improve mentors' skill and knowledge, a majority of the participants highlighted thorough training as the means of achieving that target. One of the training sessions required by the staff is on communication skills, where they found that it is important to have sufficient communication skills to deal with the students.

Some mentors also requested training in order to increase their knowledge in the related field, as well as some technical development before they are able to perform the mentoring task for students.

*"I need more training because we are not involved in other sections. We just know a very basic info about other equipment."*

CS2-S14

Teaching skills were considered of equal importance to them.

*"We appointed mentors by their speciality or their experience, but they don't have teaching skills. So, I think management need to have a program to make sure that these mentors have appropriate teaching skills especially to teach the students."*

CS2-S8

### 5.3.6.3 Rewards

As WBL activity is considered an additional task for the staff, some of the participants explained that some rewards should be given to them as a token of appreciation.

*"Firstly, they need to provide some recognition maybe. At least something to appreciate your contribution in this program."*

CS2-S12

By giving the reward, some participants also highlighted that this scenario could encourage other staff to get involved in the mentoring activity.

### 5.3.6.4 Guideline as WBL Mentor

When conducting their role as a mentor, some of the staff suggested having clear guidelines. These should include how the staff are supposed to do the mentoring for the WBL program, as well as some rules and regulations that they should follow in order to achieve the outcomes of the program.

*“I think we should have a guideline to teach them”*

CS2-S15

### 5.3.7 Summary of Mentors’ Perspective in WBL Implementation

From the interview, Table 5.2 shows the summary of WBL implementation based on the mentor’s practice and experience.

Table 5.2: Summary of Mentors’ Practice and Experience within the WBL environment

	<b>Description</b>	<b>Mentor’s Practice and Experience</b>
AL Awareness	AL approach	WBL
	AL starts	Since 2010
	AL adoption	During MB & PPM
	AL venue	Hospital
	AL implementation	Compulsory
Experience in AL implementation	Student’s learning style	Performing work
	Written guideline	Yes
	Training	3 days (Only for selective staff)
	Institution supervision	Yes (together with WBL co-ordinator)

In general, findings from this section reveal a mixture of feelings on the staff preparedness with regards to the WBL implementation. Table 5.3 summarises mentors’ perception of their preparedness based on finding themes.

Table 5.3: Summary of Mentors' Perception of Their Preparedness Based on Finding Themes

<b>Theme</b>	<b>Description</b>
Understanding	- Confusion over practical attachment - Not clear
Unclear Direction	- Lack of awareness - Role as mentor
Unclear Syllabus	- Unsure on availability - Based on initiative
Attitude	- Individual initiative
Skill	- Sufficient technical skill - Lack of communication skill
Communication	- Proper system available

The following Table 5.4 summarises the challenges faced by mentors in WBL implementation.

Table 5.4: Challenges Faced by Mentors in WBL Implementation

<b>Challenges</b>	<b>Description</b>
Workload	Yes
Limited Time	Yes
Inappropriate knowledge	Lack of theoretical knowledge
Communication	Language barrier

## 5.4 The Management’s Perspective in WBL Implementation: The Management’s Experience

In this section, data was collated in order to seek management’s perceptions of AL implementation that has been carried out at their premises. Since the WBL program required full commitment from their staff to do mentoring while performing their daily routine, it was important to seek the management’s opinions, particularly feedback from the industry side. Figure 5.13 highlights three different levels of management representation that were involved in this research interview. For reference, Level A indicates the management representatives who were involved during the initial stages and who are also the decision makers with regards to the WBL implementation. Level B involves those who represent the region where a few sites are allocated, while level C shows actual sites where the WBL implementation is being conducted under supervision of a team leader.

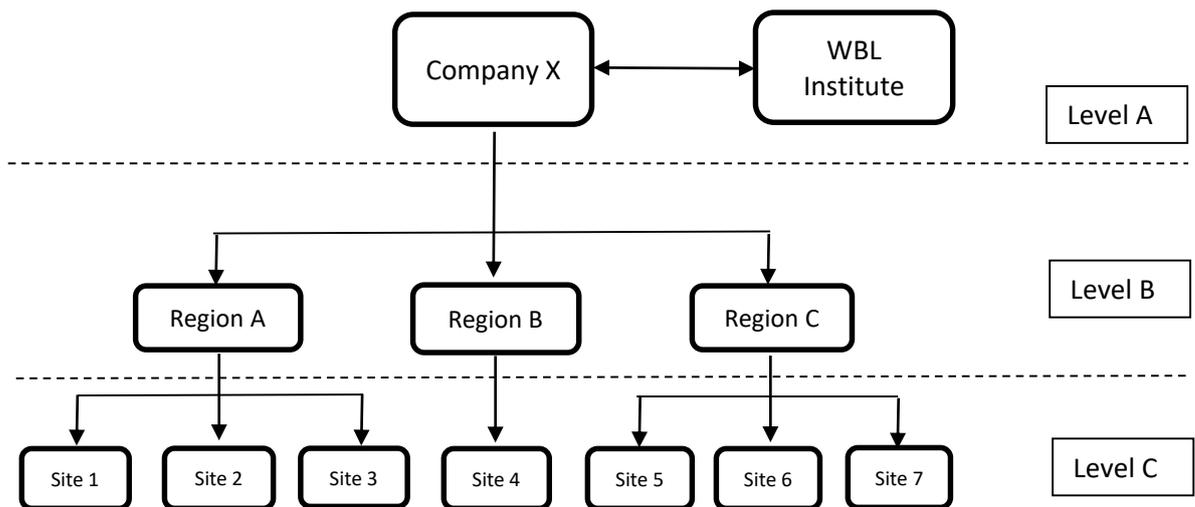


Figure 5.13: Management Hierarchy of WBL Implementation

### 5.4.1 WBL Institute - Managements’ Background and Demographic Data

Table 5.5 provides a summary of the participants’ background where the information is important in order to provide a better picture of the issues discussed and assists further analysis. Pseudonyms were given to all participants for reasons of confidentiality. The names given are based on the code below and only recognised by the researcher.

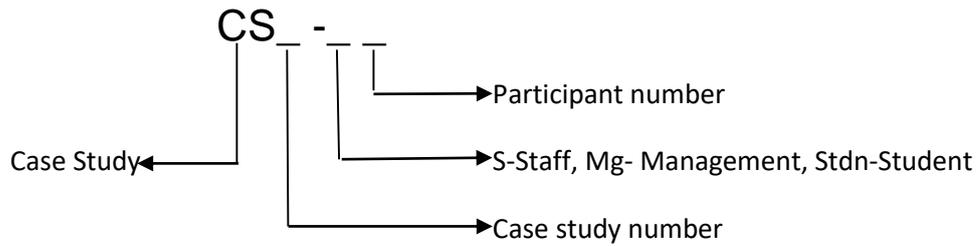


Table 5.5: Participant Profiles for Managements (WBL Institute)

Name	Highest education level	Working experience (years)			Involvement in WBL
		Before	Current company	Total	
1. CS2-Mg1	Certificate in Electronic Communication	9	17	26	2010
2. CS2-Mg2	Diploma in Electric & Electronic	9	6	15	2010
3. CS2-Mg3	Certificate in Computer Engineering	0	15	15	2013
4. CS2-Mg4	Certificate in Electronic & Electronic	2	23	25	2012
5. CS2-Mg5	Diploma in Electronic Engineering	0	17	17	2010
6. CS2-Mg6	Degree in Electrical Engineering	1	12	13	2013
7. CS2-Mg7	Diploma in Electronic Communication	2	18	20	2010
8. CS2-Mg8	Diploma in Electrical Engineering	10	17	27	2010
9. CS2-Mg9	PhD in Laboratory Engineering	0	15	15	2010
10. CS2-Mg10	Degree in Biomedical Electronic Engineering	19.5	3.5	23	2011
11. CS2-Mg11	Masters in Electronic Engineering	0	16	16	2009
12. CS2-Mg12	Masters of Business Administration	0	12	12	2011
13. CS2-Mg13	Masters	10	9	19	2011

In looking at the management's demographic data, it shows that the majority of them possess substantial experience in the related field as most of them have been working for more than 10 years with the company. With regards to findings in Chapter 5, a majority of the team leaders appointed for the WBL approach have been working for more than 15 years with the company. The same pattern can be seen with the coordinators appointed, since both possess 20 years of experience in a related field. Thus, it can be observed that the appointments were based on seniority level as well as working experience.

With regards to the participants that represent management from the WBL Institute, they were shown to possess more than 15 years of experience with the institute, where their experience help them better prepare for coordinating and monitoring the WBL approach. Thus, their wide experience in the biomedical field has helped them choose to implement WBL by embedding this AL in the course. In addition, the strong academic background found among the management staff from both the WBL institute and Company X does show that they possess good qualifications and experience in the education sector as well as in related industries, which helps them to run the program effectively.

#### **5.4.2 WBL Institute - Managements' Perception of WBL Implementation**

Feedback from one of the participants suggested that the majority of management possess negative perceptions of WBL implementation during the initial stages, as they do not understand the purpose of WBL despite having a 'long attachment' at their premises. Detailed answers also uncovered that most of them believed that the WBL approach would increase their burden in performing their daily routine.

*“At first, we feel that this is a burden for us in industry because we don't know what the purpose of this WBL is”*

CS2-Mg7

However, after 4 years of its implementation since the first students were based at their premises back in 2010, when assessing the advantages of the WBL approach, a majority of the team leaders provided positive responses to the questions posed to them.

*“.. they come to the right place with the course that they enrolled”*

CS2-Mg1

As the WBL approach required the staff to guide the students in doing activities that were related to maintenance, the requirements outlined by the WBL approach are similar to the mentor's daily routine. Thus, a majority of the management staff gave positive feedback on WBL implementation at their premises.

*“The easy thing about WBL is quite straight forward because it involves mainly maintenance and we didn't require any additional training. What they (mentor) teach the students is actually what the WBL students' need.”*

CS2-Mg3

In addition, most of the team leaders agreed that the WBL approach provided a win-win situation where they can have extra manpower in return for providing mentoring and guiding the students in the WBL activity.

#### **5.4.3 WBL Institute - Managements' Perception of Staff Preparedness**

With regards to management's perception of staff preparedness, findings indicate that a majority of the management believe that most mentors are prepared to perform the WBL activity as instructed. This is due to the fact that the mentors' daily routines are closely linked to the activities outlined by the WBL approach. Thus, the management believes that the mentors are, in fact, ready to perform the task as required.

*“They (mentor) are OK because this course is actually equipment oriented where our task is dealing with these equipment.”*

CS2-Mg1

Some of the team leaders also found that WBL activity does help the mentors to prepare themselves to be good trainers, since the mentors are also required to perform internal 'user training' as part of their role. Further findings in the following session revealed themes that relate to staff preparedness in performing the mentoring activity.

#### **5.4.4 WBL Institute - The Finding Themes from Managements' Perspective**

This section demonstrates the themes that relate to staff preparedness from the management's point of view in implementing the WBL approach. Figure 5.14 highlights five themes that were derived from the interview conducted with the management's team. Detailed information with regards to findings from the thematic network analysis are as per Appendix 22.

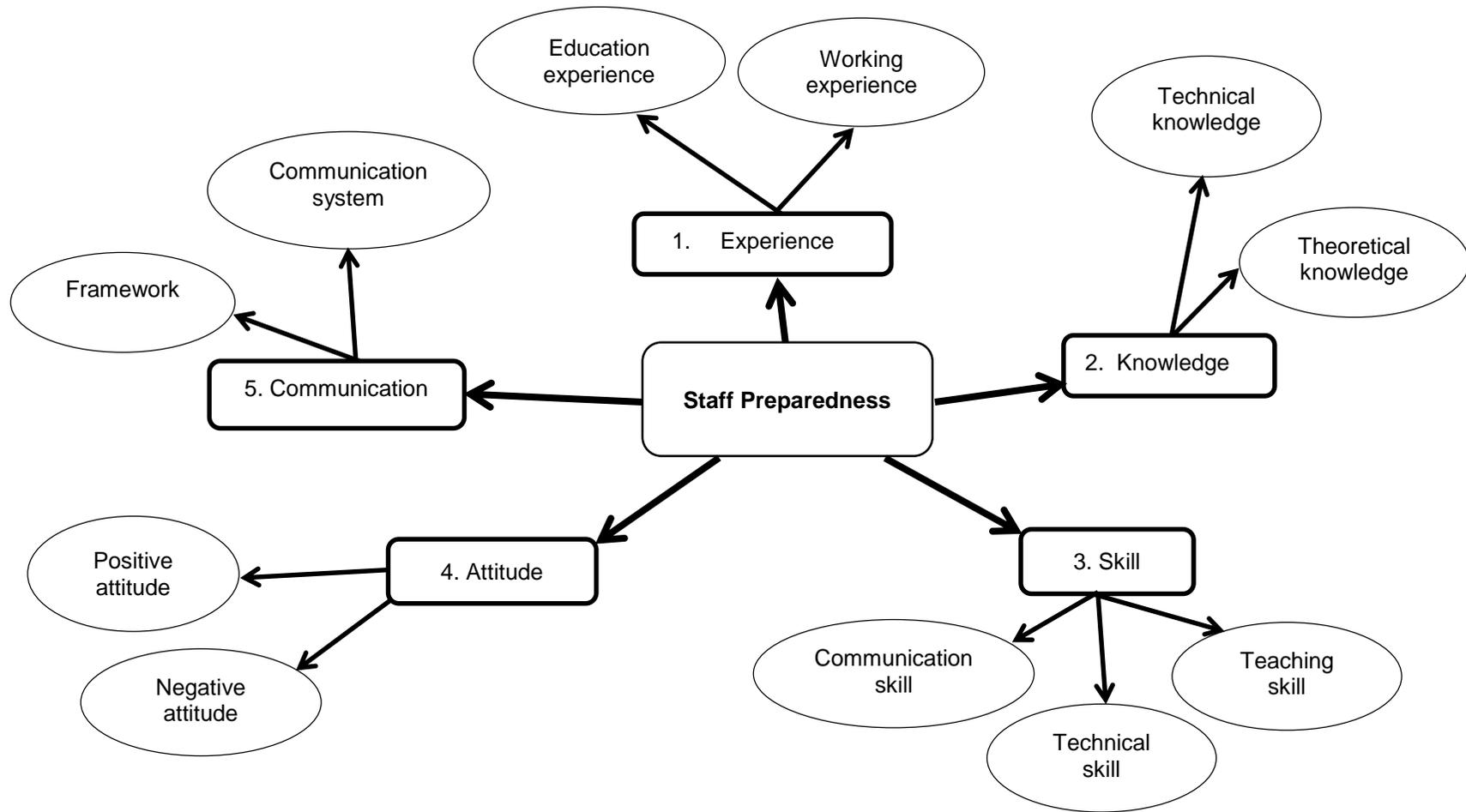


Figure 5.14: WBL Institute - Five Main Themes Emerges on the Staff Preparedness Based from Managements' Perspective

#### 5.4.4.1 Theme 1: Experience

From the interview, findings show that a majority of the management said that most of the mentors involved in WBL activity are senior staff who possess many years of experience in the field (maintenance management of biomedical equipment). As WBL activity is similar to what mentors do in their daily job, thus, all participants believed that the selected mentors should not have any problem with implementing the WBL approach.

*“.. majority of my staff are considered as senior staff, so they are considered as an expert in their area actually and I think they don't have any problem to deliver to the students but it also depends on the student.”*

CS2-Mg3

Furthermore, feedback from management reveals that the WBL approach is similar to the internship program completed by previous students. As most of the mentors were used to dealing with students, this experience helped them to prepare to be a mentor for the WBL approach.

Further findings also revealed that the company previously had its own internal 'mentor-mentee' program, which was similar to the WBL approach. Thus, as the majority of the senior staff had been involved in the 'mentor-mentee' program before, their previous experience helped them to better prepare other staff in performing the task of 'mentor' as required by the WBL approach. In addition, the guidelines and reference books prepared for the internal 'mentor-mentee' program are still being used as additional support for the mentor to perform their task in coaching and guiding the WBL students.

*“For me, they don't have any problem to be the mentor and in fact before this, we do have our own mentor-mentee program before WBL.”*

CS2-Mg7

#### **5.4.4.2 Theme 2: Knowledge**

Most of the participants felt that mentors should possess a good degree of knowledge in order to fulfil the role successfully, in addition to sufficient technical knowledge and theoretical knowledge in the biomedical field.

However, some feedback from participants suggested that the knowledge that the mentors possess is limited to performing daily maintenance work and not as detailed as students would have expected or wanted. Findings also reveal that the mentor's knowledge and experience in the related field does help the mentor to perform mentoring and coaching for the WBL students.

*“We are not focusing on theory, we are more on practical and problem solving.”*

CS2-Mg4

#### **5.4.4.3 Theme 3: Skill**

With regards to the third theme, findings reveal that, apart from necessary knowledge as highlighted before, all the mentors are also required to possess necessary skills in order to perform their task as a prepared mentor. As WBL activity is related to the maintenance management of biomedical equipment, one of the most important skills that the mentor should possess is good technical skill. This is due to the nature of their work. Thus, a majority of respondents highlighted that technical skills are important for the mentor to guide and coach the students.

Findings also reveal that the staff should possess good communication skills. By having good communication skills, mentors are capable of delivering necessary information to the students. The skills required enhance the mentoring process by helping the students to further understand the actual working scenario.

As their main daily task do not involve teaching or training, when they are allocated as a mentor for this WBL activity, teaching skill would be used in order to deliver their knowledge effectively for the WBL implementation. Thus, necessary training for the mentors is required to better prepare them to be a 'proper teacher'.

*“For this mentor to be a teacher, they need to be trained as a teacher first. We have a lot of technical training but we need more on teaching skill.”*

CS2-Mg2

#### **5.4.4.4 Theme 4: Attitude**

Responses from the management also highlighted that the staff attitude does play a major role in successful WBL implementation. One of the main attitudes that the mentor should have is a willingness to teach the students. As the mentors are busy with their daily routine handling breakdowns and performing maintenance work, the WBL activity is an additional task given on top of their initial job scope. Thus, their willingness to undertake the mentoring job affects their preparedness as they need to properly manage their working schedule and time in order to accommodate the WBL requirements.

*“Staff also must willing and have the interest to teach them.”*

CS2-Mg2

#### **5.4.4.5 Theme 5: Communication**

From the interviews, findings indicate that proper communication is vital in preparing the mentor for the WBL approach. As the implementation of the approach involves different parties, proper communication among related representatives is vital. Findings also show that electronic communication such as e-mail is one of the main communication mediums used. However, as the internet facilities are limited for access, most of the information for members on the shop floor is conveyed through normal briefings, such as a morning roll-call or meeting.

In addition to this, findings also reveal that the WBL Institute plays an active role in introducing the approach during the initial stage. This includes conducting some road shows regarding the WBL approach to the related parties involved.

*“Normally we communicate through the email and we received feedback from HQ. In the HQ, we do have 1 coordinator at HQ level to deal with WBL Institute. Whatever message from WBL Institute will cascade down to regional and we will share among us.”*

CS2-Mg7

However, findings also found that some of the management possess a lack of information with regards to WBL implementation and activity, especially those participants who were not involved from an early stage. Thus, their knowledge and awareness of WBL were just based on their peers' information.

#### 5.4.5 WBL Institute - Challenges Faced by Staff From Management's Perspective

Figure 5.15 shows the challenges highlighted by participants with regards to WBL implementation. Findings also indicate the obstacles faced by the mentors from the point of view of management.

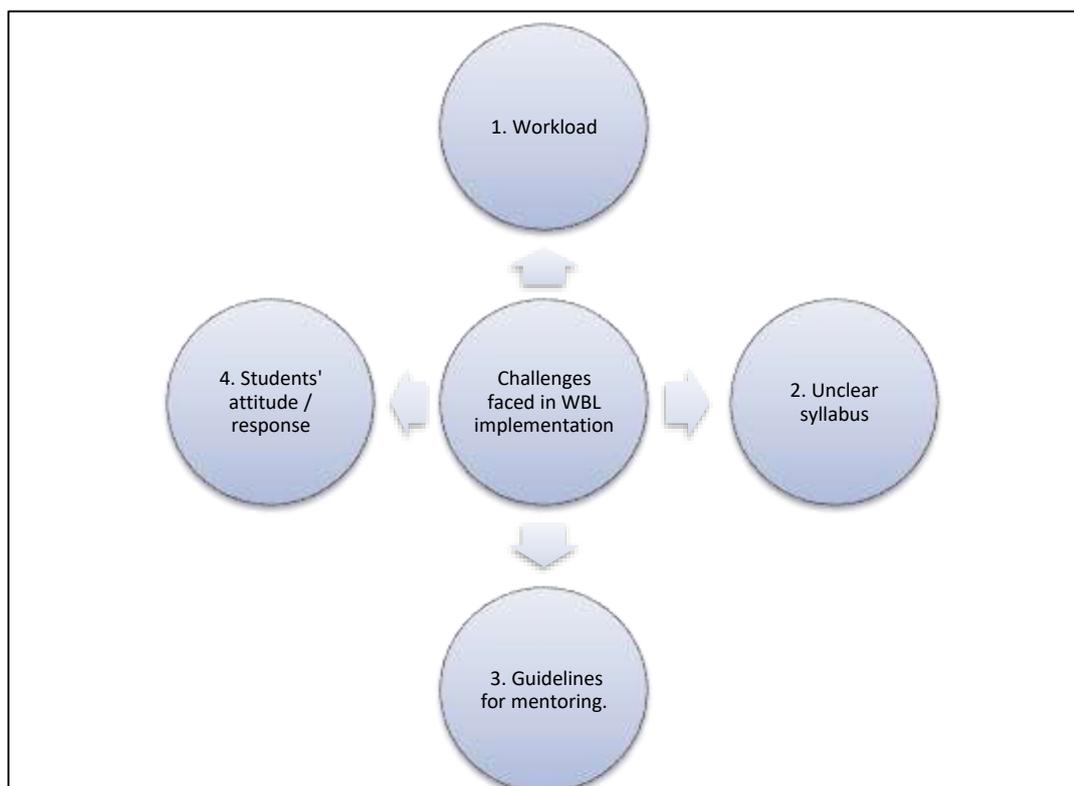


Figure 5.15: WBL Institute - Challenges Faced by Mentors from Management's Perspective

##### 5.4.5.1 Workload

A majority of the participants expressed concern over the workload faced by the mentors, as they have to perform their main daily tasks at the premises in addition to the mentoring job. This includes performing maintenance on the medical equipment,

dealing with the breakdowns and conducting training for users. Thus, some of the participants raised concerns that the situation might cause improper or inadequate mentoring.

#### **5.4.5.2 Unclear syllabus**

In conducting a WBL approach, one of the issues raised by the participants is an unclear syllabus that mentors should cover. According to the feedback, a majority of the mentors simply share their knowledge based on their understanding and experience. Thus, most mentors are concerned with the possibility that some syllabus is not being covered due to work commitments. In addition to this, they are also concerned with the improper and unstandardized syllabus used by the mentors.

*“The syllabus is based on the topic only but it's not detailed enough.”*

CS2-Mg6

In addition to this, the unclear syllabus has sometimes made it difficult for the students to complete the test given to them, as some of the information they need is not properly conveyed by the mentors during WBL sessions. Thus, this situation has been seen to be unfair to the students.

#### **5.4.5.3 Guidelines for Mentoring**

With regards to WBL implementation, a few participants expressed concerns over how the mentoring should be done. Findings from the interviews reveal that a majority of the mentors just provide a simple briefing and explanation based on the list of equipment provided. As the mentoring session is normally done while the mentor is performing their maintenance work, the WBL activity is normally conducted at on-site and impromptu situations. Thus, some of the team leaders expressed their concern about the effectiveness of mentoring.

*“We are lacking in guidelines by the WBL Institute on how they want us to teach the students.”*

CS2-Mg6

In addition to this, some participants highlighted a different style of coaching given to the students as there are concerns on how efficient the knowledge conveyed to the students is.

#### **5.4.5.3 Students' Attitude / Response**

In conducting this WBL approach, one of the challenges raised by the management was caused by the students themselves. There are a few issues raised by the participants where the students were not seriously involved in the activity arranged for them. From the interview, there were cases where some of the students refused to perform the task given by the mentor. Thus, the situation had caused dissatisfaction to the mentors as they had tried their best to commit to the WBL program despite their hectic daily routine.

In addition to this, responses from participants also stressed that the students should be pro-active during the WBL activity and not just depend on the mentors to teach them. Some of the participants were also concerned that the students do not know how to utilise their chances given during the WBL program, and should use the opportunity to learn and explore the field as widely as possible.

#### **5.4.6 WBL Institute - Suggestion for Improvement by Management**

From the interview with the management, Figure 5.16 suggests some steps that can be taken in order to further improve WBL implementation. In addition, the suggestions proposed are intended to better prepare the staff in implementing WBL approach.

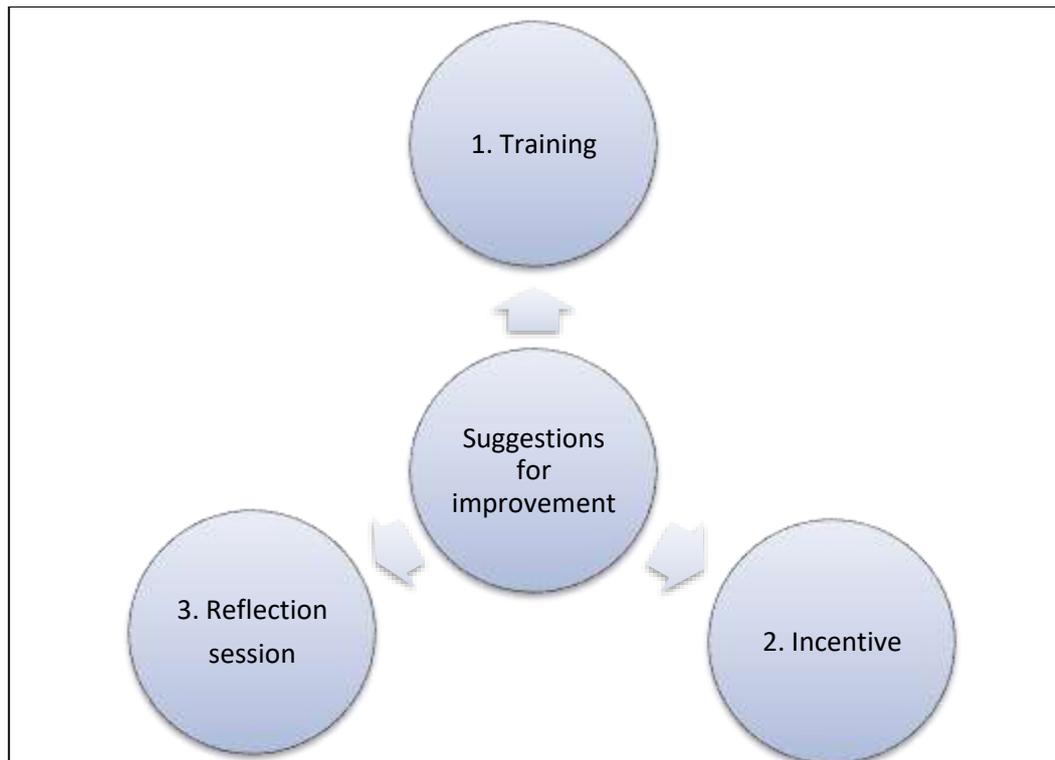


Figure 5.16: Suggestions for Improvement from WBL Management

#### 5.4.6.1 Training

A majority of respondents agree that most of the mentors required proper training in order to become a better prepared mentor. There are concerns on how to train the mentors to convey their knowledge to the students effectively. As the training provided to the mentor before focused on technical training, some of the participants suggested necessary training to improve their teaching skills. Furthermore, refresher training was also considered necessary as the program is running on a yearly basis and regularly involves new mentors.

*“Training on how to be a teacher is the most important thing because it is not meaningful if the mentor knows many thing but is unable to convey his knowledge properly.”*

CS2-Mg6

Moreover, a majority of participants suggested that staff should be required to improve their communication skills, as feedback from the team leader revealed that most of the mentors were able to teach and do the coaching for the WBL activity but are unable to speak in front of a large group of people.

#### **5.4.6.2 Incentive**

As the WBL program was done based on ‘social contribution’ from the company, there is no special remuneration allocated for the WBL activity. Despite spending their time and effort performing mentoring while doing their daily tasks, the majority of the management suggested that incentives should be given to the mentors as a token of appreciation for their efforts. In addition, an incentive is believed to encourage mentors to be better prepared for their role.

#### **5.4.6.3 Reflection Session**

In order to improve staff preparedness, one suggestion by a participant is to have a reflection session internally. The session would be planned in order to get feedback from the students on how the staff perform during WBL sessions so that mentors can improve their performances.

*“...we try to get input from students and mentor as well for improvement.”*

CS2-Mg6

#### **5.4.7 Summary of Managements’ Perspective in WBL Implementation**

Table 5.6 summarises the managements’ experience with regards to WBL implementation. From the interview, the following Table 5.7 describes the themes on the mentor’s preparedness in WBL implementation based on the managements’ perspective. Table 5.8 summarises the challenges faced by the mentors as observed by them in implementing WBL approach.

Table 5.6: Summary of Managements' Practice and Experience within the WBL environment

	Description	Mentor's Practice and Experience
AL Awareness	AL approach	WBL
	AL starts	Since 2010
	AL adoption	During MB & PPM
	AL venue	Hospital
	AL implementation	Compulsory
AL Practice & Implementation	Student's learning style	Performing work
	Written guideline	Yes
	Institution supervision	Yes (together with WBL co-ordinator)

Table 5.7: Summary of Managements' Perception on the Mentors' Preparedness Based On Finding Themes

Theme	Description
Experience	<ul style="list-style-type: none"> <li>- Senior staff as WBL mentor</li> <li>- Similar to internship program</li> </ul>
Knowledge	<ul style="list-style-type: none"> <li>- Sufficient technical knowledge</li> <li>- Sufficient theoretical knowledge</li> </ul>
Skill	<ul style="list-style-type: none"> <li>- Sufficient technical skill</li> <li>- Lack of teaching skill</li> <li>- Lack of communication skill</li> </ul>
Attitude	<ul style="list-style-type: none"> <li>- Individual initiative</li> </ul>
Communication	<ul style="list-style-type: none"> <li>- Proper system available</li> </ul>

Table 5.8: Summary of Challenges in WBL Implementation From Management's Perception

Challenges	Description
Workload	Yes
Unclear syllabus	Unsure on the availability
Guideline for mentoring	Individual initiative
Students' attitude	Passive

## 5.5 Students' Perspective in WBL Implementation: The Academic Experience

This section offers the findings from focus group interviews with students who experienced 8 months of the WBL approach at selected sites. The students were allocated based on availability at seven different sites assigned by the management of Company X. The interviews sought the students' perceptions of the staff preparedness for the WBL approach as well as to triangulate the findings from sections 5.3 & 5.4.

### 5.5.1 WBL Institute - Students' Background and Demographic Data

Table 5.9 shows the profiles of those involved in the focus group at the different premises. For this focus group interview, a total of seven groups of two to four participants were involved on a voluntary basis for each session. The identification used for the focus group participant is shown below.

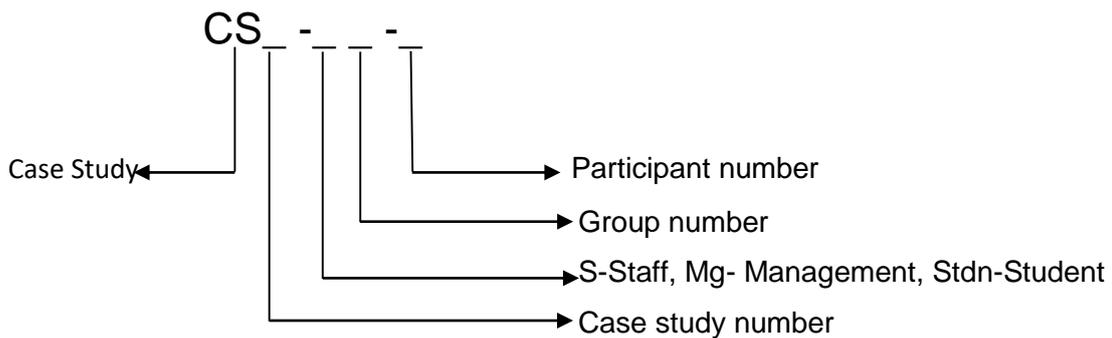


Table 5.9: WBL Institute - Participants Background for Students

<b>Group</b>	<b>Group background</b>
CS2-Std1	This group were conducting their WBL at Site 1. Total of 4 students were allocated at the premises.
CS2-Std2	This group are conducting their WBL at Site 2. Total of 2 students were allocated at the premises.
CS2-Std3	This group are conducting their WBL at Site 3. Total of 3 students were allocated at the premises.
CS2-Std4	This group are conducting their WBL at Site 4. Total of 2 students were allocated at the premises.
CS2-Std5	This group are conducting their WBL at Site 5. Total of 3 students were allocated at the premises.
CS2-Std6	This group are conducting their WBL at Site 6. Total of 3 students were allocated at the premises.
CS2-Std7	This group are conducting their WBL at Site 7. Total of 2 students were allocated at the premises.

### 5.5.2 WBL Institute - Students' Perceptions of AL Implementation

With regards to the WBL approach, a majority of the feedback across the focus group provided positive responses to WBL implementation. Most of the participants appreciated the experiences that they had during the WBL session. One common response to WBL implementation was that the approach provided better understanding and offered more knowledge, particularly in technical skills. In addition, a majority of participants across the group indicated that the WBL approach provided an opportunity to better understand their actual working scenario.

*“Actually WBL gave us experience in this area and it's important for us when we want to apply for a job later.”*

CS2-Std4-2

In looking for an understanding of the WBL approach, a majority of the findings across the focus groups understand WBL as a method where the students learn while working. However, some of the participants claimed that they do not understand the approach well, especially during the initial stages, as they believed the WBL approach is similar to normal practices, just longer. Nevertheless, their understanding improved after undergoing WBL activities as required.

*“Last time, we also not sure what is WBL but now we know what is WBL”*

CS2-Std4-2

### **5.5.3 WBL Institute - Students’ Perceptions of Staff Preparedness**

From the students’ perspectives, a majority of responses across the focus groups believe that mentors are prepared for WBL activity.

*“For me, they are prepared”*

CS2-Std4-1

Responses from most participants also highlighted that appointed mentors managed to do the mentoring job by providing necessary guidance within the duration provided for WBL activity. However, some participants also highlighted that mentors preparedness can be further improved for better implementation.

### **5.5.4 WBL Institute - The Finding Themes from Students’ Perspective**

Based on the findings across focus group, this section highlights three main themes associated with the mentor’s preparedness for WBL implementation, as shown in Figure 5.17. In general, the themes derived from the students’ perceptions are commensurate with the themes discussed in sections 5.3.4 and 5.4.4. Detailed information with regards to findings from the thematic network analysis are as per Appendix 23.

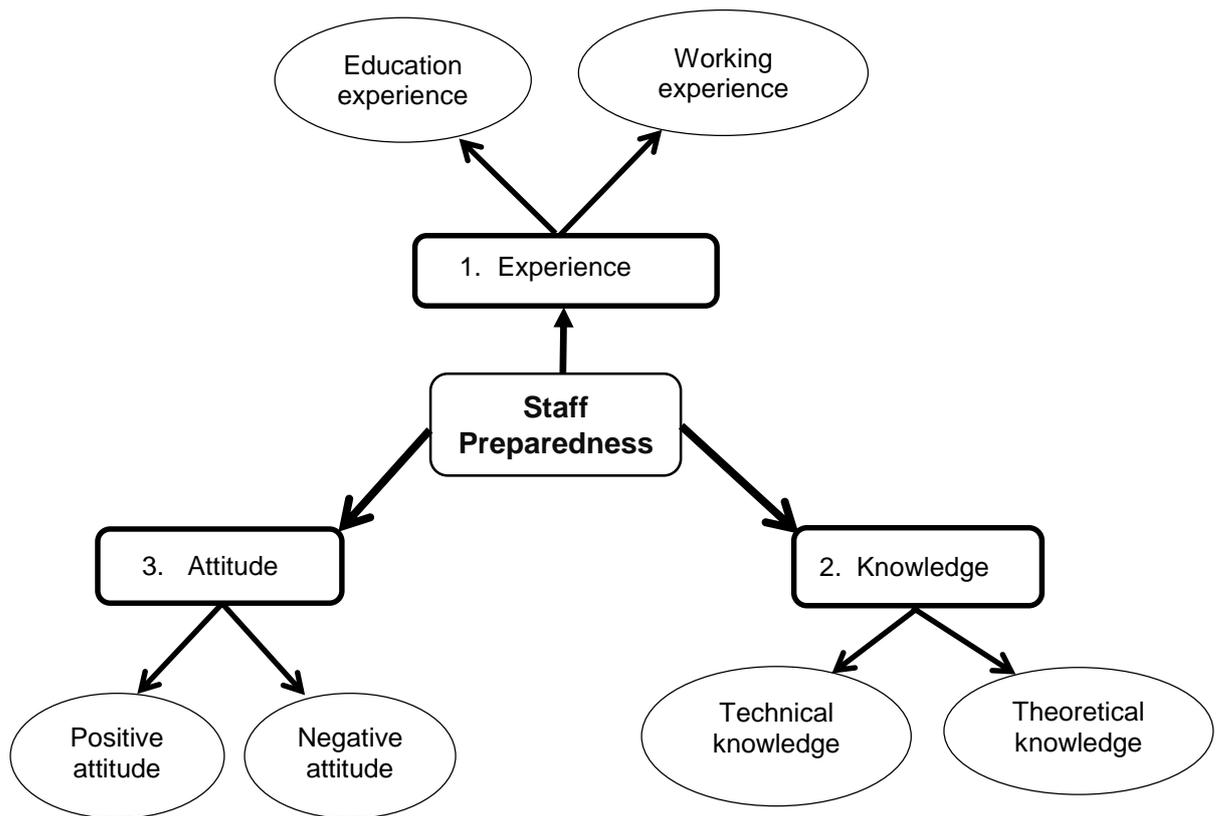


Figure 5.17: WBL Institute - The Finding Themes from the Students' Perspective

#### 5.5.4.1 Theme 1: Experience

Findings across the focus groups indicate that most of the mentors possess appropriate experience, which helps them to prepare for conducting the WBL approach. In detail, findings show that factors such as sufficient working experience contribute to mentors' preparedness.

*"I think it is more on spontaneous activity based on their experience. I think if unexperienced mentor, maybe they don't prepare enough. "*

CS2-Stdn1-3

In addition, findings across the focus groups also highlighted that a majority of mentors are quite familiar with WBL requirements due to their involvement with previous WBL activity as well as other internship programs. Furthermore, some participants also highlighted that a few mentors who graduated from the same course managed to understand the WBL approach better. One mentor, in particular, who

graduated from a course employing the WBL approach, managed to show his preparedness very well during implementation.

#### **5.5.4.2 Theme 2: Knowledge**

Responses across the focus groups showed that a majority of the mentors involved in WBL activity possess sufficient knowledge, which entitles them to be regarded as experts in their field. Thus, their wide knowledge enhances their preparedness for dealing with WBL activity.

*“I think, for all the staff here, they have their own expertise. So they just explain on what they have been doing every day and they are experts in this area. It is just that they convey the knowledge to us.”*

CS2-StdN2-2

Feedback also shows that most of the mentors are secure in their technical knowledge and practical skills which is the niche for WBL implementation. Thus, a majority of respondents revealed that mentors prefer to have mentoring sessions while attending a breakdown, where they can do the coaching on an actual situation.

However, some focus groups indicated that certain mentors lack theoretical knowledge, as they required the students to do their own study despite many years of experience.

#### **5.5.4.3 Theme 3: Attitude**

Findings across the focus groups demonstrated that a majority of mentors have a positive attitude to conducting WBL activities. Most of the respondents revealed that mentors are willing to teach and guide them during mentoring sessions. In addition, mentors are also willing to share their knowledge and are eager to teach the students.

*“They are keen to teach us actually. Sometimes they called us to follow them (to attend breakdown).”*

CS2-StdN2-2

However, further responses from participants showed that there are some mentors who are not willing to guide them as they had shown signs of indifference during WBL mentoring, which had caused the students to feel uncomfortable.

### 5.5.5 WBL Institute - Students' Challenges Faced by the Students in WBL Implementation

This sub-section explores the challenges faced by students with regard to WBL implementation, as per Figure 5.18. In addition, the findings also relate to the staff preparedness from the students' point of view that reflects on how the WBL approach was implemented.

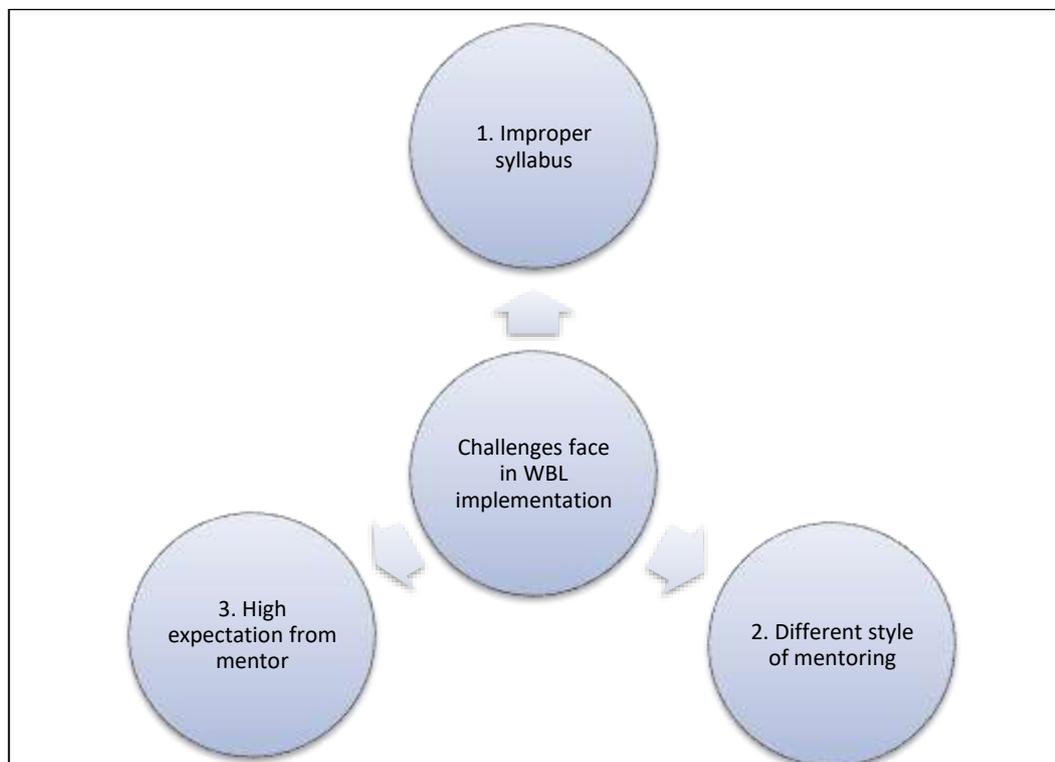


Figure 5.18: Challenges Faced by Students During WBL

#### 5.5.5.1 Improper Syllabus

A majority of participants said that their mentoring activity is done based on the schedule given by the institute. The WBL sessions were conducted mainly based on the breakdown and maintenance activity that related to the medical equipment which each mentor is required to handle. As the learning process was done in an informal

manner, thus the sessions normally depended on the mentors' initiative as to how they conveyed information to the students. Some of the participants also revealed that the explanations were generally based on mentors' experience as there is no proper syllabus to guide the mentor during the sessions.

*“There is no detailed chapters, but they will teach based on what they know.”*

CS2-Stdn5-1

#### **5.5.5.2 Different Style of Mentoring**

With regards to this issue, findings from participants revealed that some students experienced difficulties with how the mentors conducted the mentoring sessions. While most of the mentors provided explanation and the students just listened to them, some of the mentors preferred to ask questions of the students rather than simply supplying information. Thus, some of the students expressed their uneasiness with this situation as most of them were used to be in teacher-oriented education.

#### **5.5.5.3 High Expectation from Mentors**

Responses from across the focus groups also show that a majority of the mentors have high expectations of the students during WBL sessions. Feedback from participants also claimed that a majority of the staff expected the students to be aware of, and properly understand, the medical equipment that they need to learn. Hence, the students sometimes feel awkward during the session as they are struggling to catch up with the information given by the mentors.

*“For me, since we are still a student, they cannot just simply ask us questions and expect us to know everything. For sure we don't know.”*

CS2-Stdn6-2

### 5.5.6 WBL Institute - Suggestions for Improvement by Students

Findings across the focus groups highlighted suggestions that can be considered in order to further improve WBL activity, as shown in figure 5.19. In addition, the suggestions proposed will hopefully better prepare the mentor in implementing the WBL approach in near future.

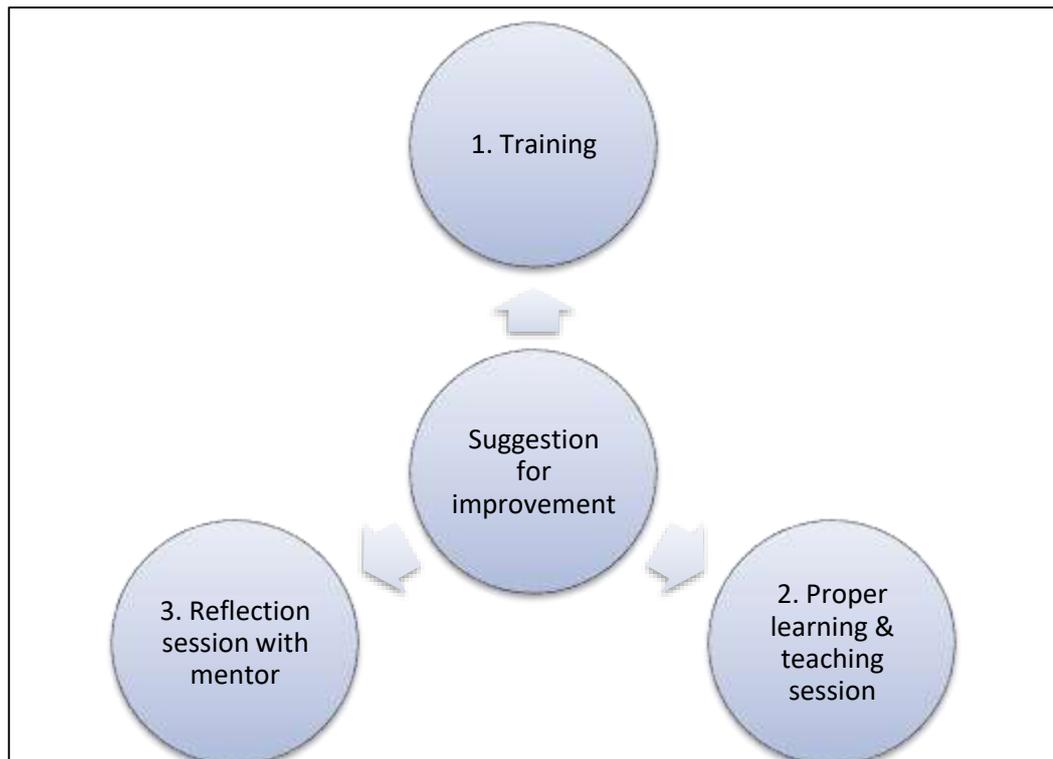


Figure 5.19: Suggestions for Improvement from Students' Perspective

#### 5.5.6.1 Training

One of the main suggestions highlighted by participants across the focus groups is to provide necessary training to mentors which can better prepare them for WBL activity. A majority of the participants wanted mentors to improve on how they could deliver knowledge effectively. The training should include advice on how the mentor can improve their communication skills, as it is important for them to deliver information appropriately.

In addition to that, some participants also suggested that there should be some special arrangement to prepare the mentor for WBL activity, as this approach has been

done on a yearly basis at the premises. Thus, the mentor should always be ready and know what to deliver for the WBL activity.

*“In order to be a mentor, I think the company should provide training for a few staff first since they know that we will be based here for the program. Maybe they need to know how to handle us, teaching and learning so that it is more organized.”*

CS2-Std5-1

#### **5.5.6.2 Proper Learning & Teaching Sessions**

Some of the participants across the focus groups would prefer it if mentors were able to provide proper classes during WBL activity. Even though the mentors are busy with their daily tasks and duties, some participants suggested that there be a class at least once a week. According to respondents, the class is ideally meant for the theoretical session that relates to the equipment used.

*“I think it’s better if they can provide any class”*

CS2-Std3-1

In addition, some participants requested that a module could be prepared for them to which they could refer with regards to WBL implementation.

#### **5.5.6.3 Reflection Session with Mentors**

Responses across focus groups also highlighted that a majority of participants required mentors to get involve in their activity required throughout the WBL session. For this reason, participants suggested whether a reflective session with mentors could be introduced in order to make sure that their WBL activity was effective with appropriate knowledge received.

#### **5.5.7 Summary of Students’ Perspective in WBL Implementation**

Table 5.10 summarises the students experience with regards to WBL implementation while Table 5.11 shows the themes derived on the mentors’

preparedness based on the students' perspective. Table 5.12 shows the challenges that students face in WBL implementation.

Table 5.10: Summary of Students' Experience in WBL Implementation

	Description	Mentor's Practice and Experience
AL Awareness	AL adoption	Every topic
	AL venue	Hospital
	AL implementation	Compulsory
Experience in AL implementation	Previous AL experience	None
	AL training	1 week training
	Written guideline	Yes

Table 5.11: Summary of Students' Perception on Mentors' Preparedness Based on Finding Themes

Theme	Description
Experience	<ul style="list-style-type: none"> <li>- Working experience</li> <li>- Similar mentor-mentee program</li> </ul>
Knowledge	<ul style="list-style-type: none"> <li>- Sufficient technical knowledge</li> <li>- Sufficient theoretical knowledge</li> </ul>
Attitude	<ul style="list-style-type: none"> <li>- Individual initiative</li> </ul>

Table 5.12: Summary of Challenges Faced by Students in WBL Implementation

Challenges	Description
Improper syllabus	Mentor's initiative
Different style of mentoring	Individual initiative
Expectation from mentor	High

## **5.6 Conclusion for Case Study 2**

In conclusion, findings from Case Study 2 underscore that the staff who are involved in the WBL approach (better known as mentors) generally think that they have had enough preparation to implement the AL. As in the WBL approach, the staff are required to provide necessary mentoring and guidance in the activity which is similar to their daily task, hence, a majority of respondents believe that the mentors are capable of performing the WBL mentoring. However, detailed findings reveal that they are not, in fact, aware that the preparation that they have done is not sufficient to achieve the AL target effectively.

Issues like insufficient training among mentors has led them to possess an inadequate understanding and awareness of the WBL approach. For instance, some mentors are not aware on the availability of important documents such as WBL guideline, subject outline and etc, that hinder effective WBL implementation. This can be seen where the WBL implementation was done mainly on mentors' initiative with the help of their working experience. Issues like the absence of WBL guidelines for mentoring has caused improper coaching and mentoring sessions, as there is no standardisation in implementing the WBL process. In addition to this, other findings from three different sub-groups were found to be coherent particularly on an issue like training.

## **CHAPTER 6 : QUALITATIVE ANALYSIS AND KEY FINDINGS**

### **6.1 Introduction**

The purpose of this chapter is to draw a clear picture from the two case studies presented in the preceding chapters. Thus, further analysis will lead to answer the main research question on how prepared staff are with regard to the introduction of an Active Learning (AL) approach within engineering education. In order to fill the research gap, further analysis will provide appropriate answers to the sub-research questions.

In order to fulfil this aim, this chapter will focus on interpreting the analysis from the staff as well as the management interviews. In addition, the voice of the students from the focus groups will be used to triangulate the findings. Hence, the voices from different stake holders will clarify any points of confusion and add additional explanation to their experience of the AL approach employed.

To further understand the layout of this chapter, each sub-section will present the analysis based on each case study before presenting the cross case analysis from the research findings as a whole. Each sub-section will start by analysing the demographic data of the participants involved, before examining the participants' perceptions on AL implementation which subsequently leads to the evaluation of the staff perception of their preparedness. Further analysis will then be based on the themes observed. It is important to highlight that the presentation is done in such a way to avoid repetition as the data was taken from three different stakeholders where the same questions were used.

### **6.2 Analysis of Findings for Case Study 1**

This section will analyse the findings from Case Study 1 which involved the PBL Institute.

#### **6.2.1 Demographic Analysis for Case Study 1**

In analysing the demographic data, the analysis is based on two different categories; staff and management and the students. As the participants in the staff and management category possess similar backgrounds, whereby the management were

previously teaching staff that have been promoted to management level, the analysis of these two stakeholders will be done together, while the demographic analysis for the students will be done separately. A total of 24 participants were involved in the interviews within this category, 20 staff and 4 management level participants.

### 6.2.1.1 Case Study 1 - Staff and Management

Table 6.1: Analysis of Staff and Management Demographic

Participants	Staff (20)	%	Management (4)	%	Total (24)	%
1. Highest education level						
Bachelor Degree	7	35	0	0	7	29
Masters Degree	13	65	4	100	17	71
2. Background in Engineering						
None	5	25	1	25	6	25
Engineering graduate	15	75	3	75	18	75
3. Total Working Experience						
< 2 years	1	5	0	0	1	4
More than 2 to 5 yrs	3	15	0	0	3	13
More than 5 to 10 yrs	6	30	0	0	6	25
More than 10 to 20 yrs	9	45	1	25	10	42
More than 20 year	1	5	3	75	4	16
4. Working Experience in current Institute						
< 2 years	2	10	0	0	2	8
More than 2 to 5 yrs	9	45	0	0	9	38
More than 5 to 10 yrs	6	30	0	0	6	25
More than 10 to 20 yrs	3	15	1	25	4	16
More than 20 years	0	0	3	75	3	13
5. Experience in PBL approach before						
Yes	2	10	0	0	2	8
No	18	90	4	100	22	92

With regards to educational background, Table 6.1 shows that most of the participants possess at least a Bachelor Degree in a related discipline while more than half of the total participants hold a Masters Degree. In addition, it is also understood that two participants are pursuing study at PhD level part-time, which also aligns with the government target to increase the number of lecturers with a PhD qualification in Malaysia (Grapragasem, Krishnan & Mansor, 2014). It is also observed that most of the staff that are involved graduated with an engineering qualification.

In looking at the participants' experience within the staff category, only one participant was recorded to have freshly graduated and then joined the institute as a lecturer. The majority of participants possess at least 1 year of experience working in

industry before holding their teaching position. Detailed analysis reveals that 70% of participants possess at least 1-year experience in industry whilst ten participants were recorded to have more than 10 years of experience in the engineering sector. With regards to PBL implementation, few participants agree that their experience in industry does help them in PBL implementation.

*“For me, as I worked as a Senior Engineer in my previous company, 1-year experience doesn’t give you anything but 2 or 3 years-experience will give you something so that you can give input to the students. I think with only 1-year experience, you won’ t get enough information compared to 2 or 3 years.”*

CS1-S18

With regards to the staff experience in the education line, the majority of participants have been working in the institute for at least two years and 75% of participants have been working in the institute between 2 and 10 years. However, it is also observed that some participants who possess more work experience do not necessary possess good teaching experience as some of the participants have only just joined the institute as lecturers or educators. Hence, by looking at the staff demographic background, it can be said that the staff who possess an appropriate experience and background appreciate AL approach for their learning and teaching process. As for the management’s category, it can be observed that most of the participants possess more than 20 years of working experience.

Overall, based on the participants’ background in the study, a variation in teaching experience as well as industrial experience is shown, providing valuable feedback for the study conducted. In addition, it is believed that the individual differences are unique which does affect the findings for this study.

### 6.2.1.2 Case Study 1- Students

Table 6.2: Analysis of Focus Group Demographic

Group ID	Group background	Gender		Category	
		Male	Female	Normal	Special
CS1-Std 103	Semester 3	4	1	√	
CS1-Std 203	Semester 3	5	0	√	
CS1-Std 301	Semester 1	3	2	√	
CS1-Std 403	Semester 3	2	3	√	
CS1-Std 504	Semester 4	4	1		√
CS1-Std 602	Semester 2	2	3		√
CS1-Std 702	Semester 2	5	0	√	
CS1-Std 802	Semester 2	5	0		√

As the idea of conducting focus groups is to obtain data regarding a range of feelings and ideas pertaining to certain issues, this qualitative approach provided different perspectives between groups of individuals. Thus, in order to gather meaningful findings, the members of the group should feel comfortable with each other in order to engage in the discussion.

For this study, a total of 8 focus groups were facilitated, with 5 students making up each group. From Table 6.2, it can be observed that there are two categories of groups involved in this focus group interview. In normal practice, most students who are enrolled at the PBL Institute are average students with average results. However, as the PBL Institute has offered one new program that is aimed specifically for outstanding students, a total of 3 groups identified to be from 'special groups' are involved in the focus group interviews as compared to 5 other groups come under the normal category of students who possess average grades for the institute admission. Thus, the variety of participants which make up the sampling size provides an interesting insight into the issue discussed.

From the interviews, findings across the focus groups reveal that there is no significant difference observed in terms of response from these two significant groups of students with regards to the staff preparedness. From findings, both groups manage to rectify issues regarding staff preparedness based on their experiences in

implementing PBL within related subjects which they have studied. In addition, findings from all groups manage to confirm and verify certain issues pertaining to PBL experience across the focus group interviews.

## 6.2.2 Perception of PBL Implementation

### 6.2.2.1 Staff

According to findings in Chapter 4, it is easy to observe that 90 % of the staff possess negative feedback regarding PBL implementation in their institute despite more than 4 years of its implementation. Another finding also revealed that most of the participants generally had mixed feelings towards an AL approach as employed within their institute. Figure 6.1 shows detailed lists of responses from participants that capture the mixture of feedback with regards to AL implementation.

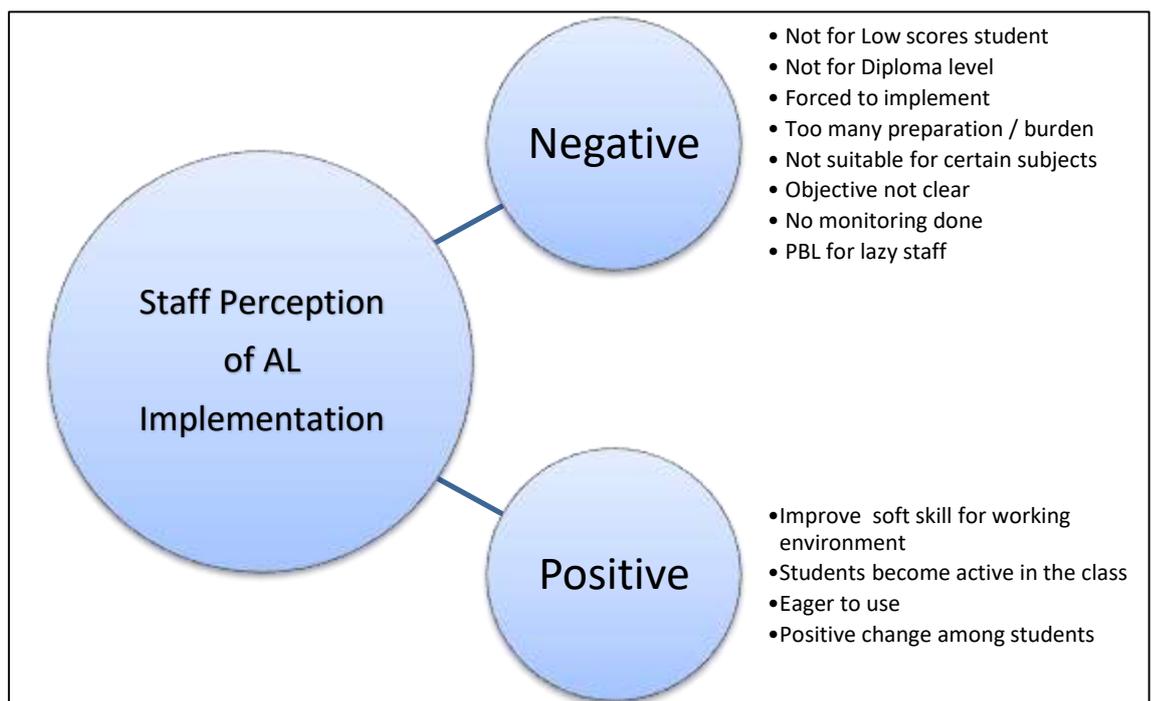


Figure 6.1: Participants' Perception in AL Implementation

Figure 6.2 shows frequency response in percentage highlighted by staff during the interview.

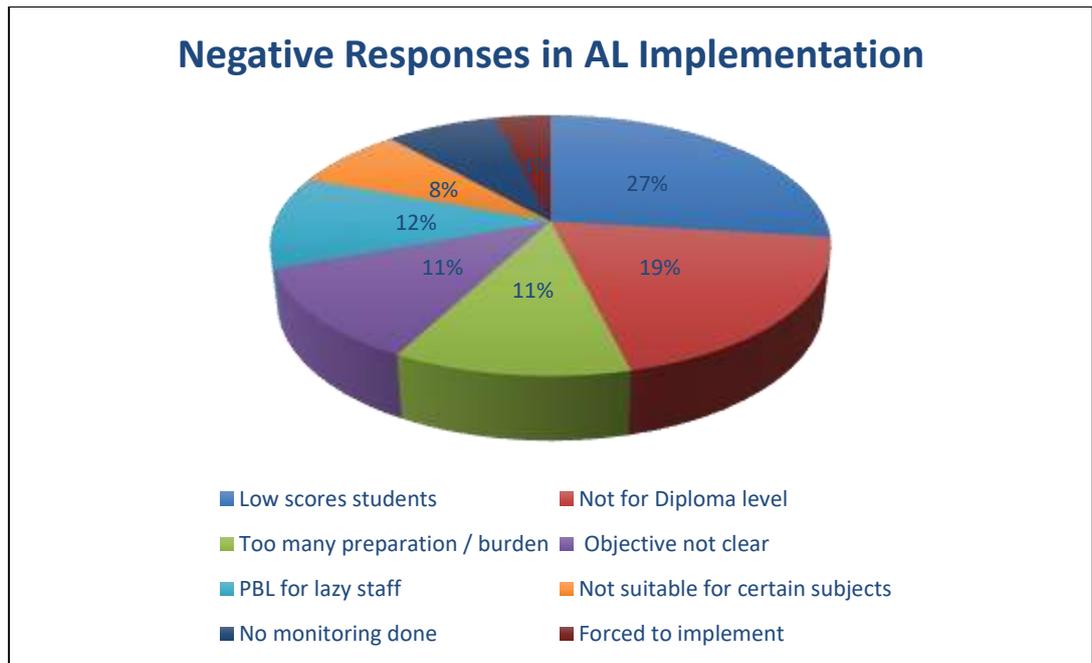


Figure 6.2: Negative Responses Highlighted by Participants

Figure 6.2 shows that more than a quarter of the participants possess negative perceptions on students' prior qualifications with regards to PBL implementation. In other words, some of them argued the students' capability to engage with PBL due to their poor qualification prior to attending the institute. Thus, with their negative perceptions about the student capability based on prior qualifications leads to the lecturers' belief that these students cannot perform well during a PBL learning process, this belief affects the implementation of PBL by these lecturers.

*“The student is not good enough; they are not capable to do the PBL. It is just wasting time. So, instead of we can finish the module in 5 hours, it takes maybe 10 to 20 hrs if you do PBL.”*

CS1-S1

In addition, as the institute produces graduates at diploma level, some of the participants highlighted that a PBL approach is not suitable to be used for diploma students. They believed that PBL approaches are only suitable to be used at degree level as the students are more mature and have the ability to do work independently. Furthermore, participants also highlighted that most of the students don't know how to do research but just copy and paste the information they find.

*“They just at diploma level if we refer to their knowledge. For example, they just depend on their existing knowledge where they just do copy and paste. They also refuse to explore more on the subject unlike they do research, as PBL approach is more towards research for knowledge. They don't have basic on how to do a research, never get exposure on how to conduct a research”*

CS1-S2

These findings highlight that most of the participant concerns are focused on the students' qualification and grades which they believe to be a major barrier for the PBL successful implementation. However, some of participants still believe that PBL approaches may provide many advantages to the students in the long run if the implementation is done correctly.

#### **6.2.2.2 Management**

With regards to the staff perception in AL implementation, analysis from the management point of view is parallel with the response given by the staff, where the students' qualification is the main concern that hinders proper AL implementation at their institute. Analysis also shows that the management highlighted the staff themselves as setting a negative perception of the students' academic background with regards to the implementation.

#### **6.2.2.3 Students**

From the point of view of the students, a significant number of negative responses received across the focus groups pertain to their perception of PBL implementation. The reactions received were similar to the response received from the staff with regards to the same question posed. Thus, this mixture of feelings confirms the actual situation with regards to the PBL implementation. In addition to this, it shows that the negative perception of AL employment is due to the confusion about the PBL approach as many different interpretations are revealed across the focus groups. Again, this situation is similar to the response received when the staff were asked the same question.

### **6.2.3 Perception of Preparedness in PBL Implementation**

#### **6.2.3.1 Staff**

With regards to results in section Chapter 4, findings show that almost half of the participants revealed their own unpreparedness despite training being provided by the institute and four years of implementation. 25% of participants tried to cover up their level of unpreparedness by reflecting that they were 'half prepared' while 20% of other participants were trying to be honest by admitting on their preparedness level. Thus, their overall response shows a significant majority of participants are not well-prepared for the implementation but tried to prepare themselves as the PBL implementation is mandatory for them.

#### **6.2.3.2 Management**

In analysing the findings from the managements' perception on the staff preparedness, it has been observed that the initial response from management is that they believe that the staff are prepared for the AL implementation. However, further analysis observed that responses from the management indirectly reveal that the staff are not prepared for the approach used.

#### **6.2.3.3 Students**

With regard to the staff preparedness, the majority of focus group responses reveal mixed results due to the participants' different experiences of staff implementation of AL approaches. The students each possess a different understanding of the AL used and their interpretation of staff preparedness is based on this understanding. There were a few similarities and differences noted across the focus groups as the students' experiences reflect certain characteristics which showed some evidence of the staff preparedness. Further analysis will be discussed in the following section.

### **6.2.4 Analysis of the Themes for Case Study 1**

In this section, the exploration of the themes found will capture the analysis of the responses from three different stakeholders; staff, management and students. This

analysis is done in such a way to avoid any repetition and duplication on the issues analysed. Table 6.3 summarises the finding themes as per Chapter 4.

Table 6.3: Summary of the Themes Derived from Participants

Themes	Staff	Management	Students
1. Understanding	√	√	√
2. Training	√	√	√
3. Leadership	√	√	
4. Staff Attitude	√	√	√
5. Support	√		√
6. Facilities	√	√	
7. Learning Culture	√	√	
8. Communication		√	
9. Planning		√	
10. Facilitation			√

#### 6.2.4.1 Theme 1: Understanding

From the researcher's observations during data collection, there are obvious findings that indicate confusion over the definition of AL used among the staff. As PBL is an approach that uses a problem to initiate the learning process, there are still misunderstandings revealed by the participants when they were asked by the interviewer to explain the meaning of PBL itself. Only a few participants managed to explain and understand what PBL means while others have different interpretations of PBL.

This issue is also raised and supported by responses from management and student groups as per the findings in Chapter 4. Due to the variety of understanding of what PBL is, most of the lecturers are unsure and not confident about the 'correctness of the PBL' that they implemented. Other comments from the staff include "don't understand the approach well" or "misunderstood the approach". Thus, the theme understanding itself actually revealed a significant impact on this study that required further analysis of related themes in order to lead to valuable findings.

However, despite misunderstandings held by quite a number of participants, there are some participants who have quite a good understanding about PBL approaches. Detailed findings reveal that these participants (n=2) have had experience of the PBL approach before as they graduated from overseas (Australia and the UK). Thus, initial exposure during their studying abroad helps them to understand the approach taken.

In addition to this, some participants who had experience in industry also highlighted that this method is the same approach that had been used in their company while doing trouble shooting. Thus it shows that, participants who had experience in industry understand the importance of the PBL approach better and accepted this approach positively.

#### **6.2.4.2 Theme 2: Training**

The theme of training was raised by all groups of participants as shown in Table 6.3, this is due to staff preparedness being closely related to the training given to them. From the point of view of the staff, the majority of participants highlight insufficient training given to them as one of the causes of their unpreparedness on the approach employed.

The graph in Figure 6.3 shows the distribution of frequency based on themes discussed by the management as per Chapter 4. From the graph, the analysis from the findings reveals that training was the main theme highlighted by the management. Thus, it shows that issues pertaining to training was discussed most frequently and emphasized by the management with regards to PBL implementation.

From the point of view of the students, they do believe that the lecturers were supposed to be equipped with necessary training before they were able to handle the class or run the PBL approach. Their concern was mainly about the newly appointed staff who do not have any experience in teaching practice.

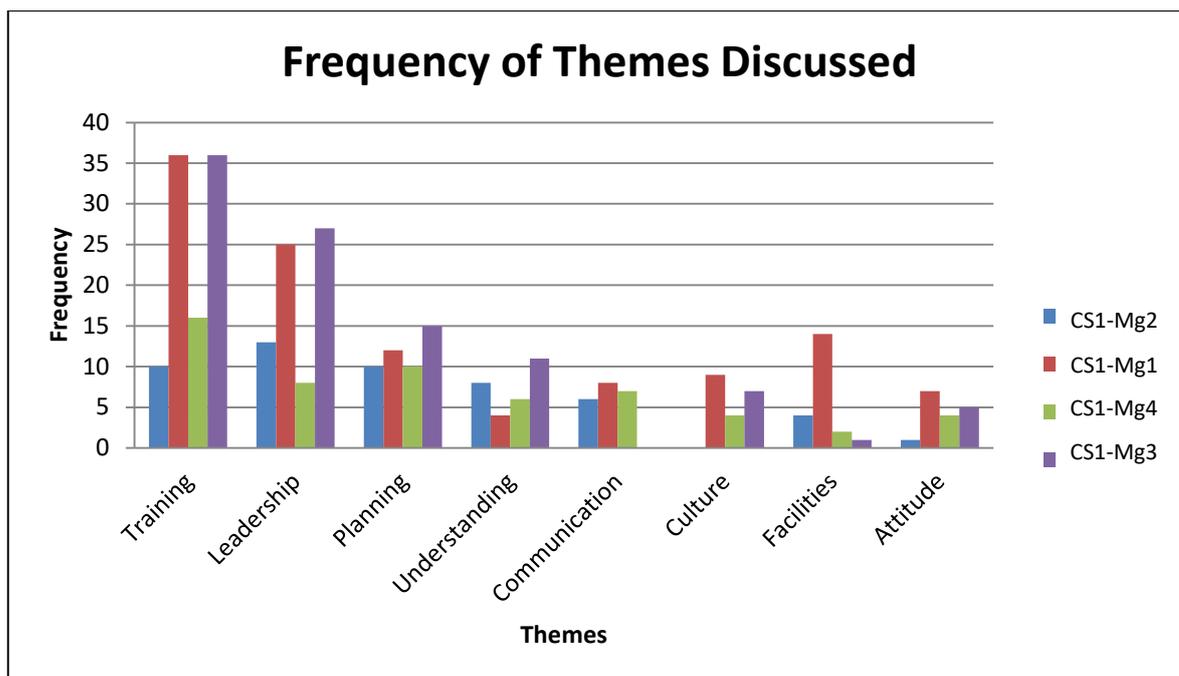


Figure 6.3: Distribution of Frequency of Theme Discussed

With regards to this theme, analysis from all findings reveal that a series of training sessions were planned gradually for the staff starting with the first semester lecturers. However, as time passed by, there was no continuity of the training found as per the initial plan. Thus, only a few workshops and training sessions were recorded during the initial stage of implementation and there is a lapse resulting in some lecturers never receiving training. Thus, this situation confirmed insufficient training as one of the reasons that contributed to the unprepared situation.

Apart from this, the situation also indirectly reflects on the next theme where leadership plays an important role for the implementation.

#### 6.2.4.3 Theme 3: Leadership

In relation to the findings, responses from the staff and the management highlight that this theme plays an important factor for AL successful implementation. Unlike the students, the absence of proper leadership is found to be one of the main issues highlighted by both of the other groups of respondents. While most of the staff blame this on the management, the management admit that this is one of the root-causes that worsened the implementation, the issue of leadership has been raised frequently as shown in Figure 6.3.

In addition, it is also understood that monitoring by the management only occurred during the early stage of implementation. However, as the monitoring was not done properly, the PBL implementation was not taken seriously throughout the institute where the lecturer ignored the need to implement PBL.

*“...they (management) need to seek out the real situation on PBL.”*

CS1-S18

#### **6.2.4.4 Theme 4: Staff's Characters / Attitude**

In developing a deep understanding of the issue of staff preparedness in this case study, most participant groups agreed that the staff's character and attitude effects successful implementation of AL. While this theme was the issue least frequently discussed by the management (please refer to Figure 6.3), the researcher believes that this theme provides a significant impact to both staff and students as they are the end-user and important characters in the actual implementation. From the findings, it can be observed that staff who possess a positive attitude will react positively with regards to the AL implementation. The situation was found to be the opposite with the staff who possess a negative attitude who prefer to find excuses not to implement the approach even though AL implementation is made compulsory to them. Thus, positive attitudes held by staff directly benefit the students whilst negative attitudes will negatively influence not only the staff themselves but also the students.

Hence, few aspects of character, such as passion and patience, are among the keywords raised by lecturers pertaining to this theme.

*“I have the knowledge in PBL, emotional level is there because when we conduct PBL we have to be patient and passionate”.*

CS1-S15

In addition to this, other elements such as confidence, are important for the lecturer to believe that the PBL approach will work and subsequently motivate them to use the approach successfully. With regards to this element, it is noted that participants who possess experience in industry appreciate the approach better as they can see the relevance of the PBL application. In other words, most of them support the implementation as they have seen how fresh graduates struggle to survive in the real world even though they are having good grades. Thus, the majority of participants who

possess experience in industry are keen to continuously adopt the approach unlike participants who joined the education sector without any industrial experience as they don't have context of the approach in industry, and thus struggle to see the relevance of implementing it in education.

*“The graduates came from various universities. It makes me inspired to share my knowledge and prove to others that graduates not only are competent in theory but also in technical as well.”*

CS1-S20

#### **6.2.4.5 Theme 5: Support**

As this theme emerged from data collected from the staff and students only, the feeling of frustration revealed as per the finding in Chapter 4 by both of these participant groups indicate that the PBL implementation instructed by the management does not tally with the support given by them.

As a result, the implementation was not done as per expected and shows some rejection by both staff and students as revealed in the findings. Thus, it is vital to make sure that necessary support is in place in order to make sure that the end user understands the importance of implementation. The absence of proper guidelines as specifically highlighted by both staff and students in Chapter 4 also shows a significant requirement on having proper guidelines or a clear framework towards proper implementation. In general, the framework should consist of how the PBL implementation should be done within the institute, also including the role and function of relevant users as well as the individuals who implement the approach.

*“Refer to the support, I think they just support the first stage. The briefing and meeting, that's all. After that, there is no follow up, no one monitor, so at the end it just happened like that, no one do the PBL anymore.”*

CS1-S2

#### **6.2.4.6 Theme 6: Facilities**

Analysis of the findings in this theme revealed that the issue of facilities has been raised by both the staff and management, unlike the students, when discussing

staff preparedness. The staff highlighted that improper facilities provided by the management is one of the barriers to proper implementation, analysis shown in Figure 6.3 opposes this opinion. Analysis of the findings shows that 'proper facilities' is among the management's lowest priorities with regards to the PBL implementation. The main concern specifically highlighted by the staff about the facilities is related to insufficient internet facilities provided, which discourages the staff and the students from proper implementation. Both groups believe internet facilities are important for them to find necessary information, not only during the AL session but also to help the staff to make necessary preparations prior to that. However, the management believe that the implementation can still be done even with minimum facilities provided. Thus, this runs parallel to findings which reveal that the facilities provided are still at minimum level particularly during the initial stage. However, a series of planned improvements was revealed by the management during the interviews. In addition it was revealed that the improvements required a large budget, this involved other parties and specific procedures needed to be followed.

*"The support is still there but we cannot expect too high or cannot expect it can be done immediately because it involves other parties as well."*

CS1-S15

#### **6.2.4.7 Theme 7: Learning Culture**

It is undeniable that this theme influences both the staff and the students with reference to proper implementation of a PBL approach within the institute, as highlighted by both staff and management. As the majority of the participants involved in this research work were from local teacher-centred education systems, it is almost impossible to break their perception that a teacher is required to initiate the learning process. The findings across the focus groups did not highlight this theme as a main barrier, however their responses still indicate that the role of the teacher as a knowledge provider is necessary as this perception has been cultured throughout the education system.

*"We learn first and then we do PBL. That is the best way, I think."*

CS1-Std103-2

#### **6.2.4.8 Theme 8: Communication**

With regards to the themes highlighted by all groups of participants, *Communication* is a unique theme highlighted by management that needs to be considered and further discussed. From the managements' point of view, inappropriate communication between relevant parties is considered by management to be the main reason for the improper implementation of PBL. Thus, it is important to prepare a medium of communication such as a proper steering committee as a referral group. In addition, the steering committee group indirectly can be a support group within the institute. It is also more effective to work towards a clear goal as a team rather than each individual creating a personal goal. Apart from this, a proper framework for PBL implementation should be initiated in order to enhance the implementation across all stakeholders. The framework can be used as a guideline for all levels of implementation and thus, will ultimately lead the institute to reach a successful level of AL implementation. In addition to this, some of the management also believe that the institute should make an effort to get involved in the AL community, particularly within engineering education in order to get necessary support and build necessary networks.

#### **6.2.4.9 Theme 9: Planning**

Apart from communication, another unique theme revealed from management is *Planning*. As the management made the decision to implement a PBL approach within the institute, it is crucial for them to consider related factors prior to implementation. The question of how long preparation should begin before the initial launch should be a consideration, findings from the interviews stated that the preparation began around 6 months prior to the initial implementation. Thus, a lack of proper planning risked improper implementation, resulting in rejection of the approach from the staff as well as the students.

*“Prior to that, I think 4 to 6 months before that. We have 3 days workshop on PBL awareness. After that we continue with PBL crafting problems.”*

CS1-Mg3

#### **6.2.4.10 Theme 10: Facilitation**

Findings across focus groups reveal that facilitation is a unique theme raised by the students as compared to other participant groups. From the students' point of view, the staff preparedness can be translated into their ability to guide the students to perform the PBL approach. Thus, one of the common issues raised by students, who are also the end user in this implementation, reveals a lack of guidance or necessary facilitation by the staff during PBL sessions. In addition, detailed analysis indicates that experienced staff tend to handle the PBL session better compared to new staff. Thus, facilitation should be focused on as an important part of staff training.

*"I think normally the ones who are not really prepared the are new lecturers to teaching or new to the subject. But for the experience lecturer, I don't think we have that problem"*

CS1-Std504-1

#### **6.2.5 Document Analysis for Case Study 1**

The documents utilised in document analysis refer to any documents that take the form of either personal or public documents related to the participants in the research study. The use of document analysis in the research work is important as it helps the researcher to interpret the content and provide voice and meaning around a particular area.

In this case study, the retrieved documents used include institute background information, assessments sheets, related procedures, curriculum procedures and course content information. The documents were reviewed as a means of gaining additional insight on the PBL implementation as well as to triangulate the findings from the interviews and focus groups. Thus, the availability of these documents may provide evidence on how prepared the staff are with regards to the PBL implementation. Apart from this, some participants referred to the function and importance of the documents with regards to the PBL implementation during the interviews. Hence, this condition reflects on how prepared the staff are with regards to the AL implementation.

### 6.2.6 Summary of Case Study 1

From the analysis of Case Study 1, it can be concluded that the staff preparedness within the PBL institute was found to be at an inappropriate level for them to implement AL. The findings themes highlighted by the three groups of participants seems to be consistent with the problems occurring during PBL implementation. Table 6.4 shows the summary of findings that conclude the analysis done.

Table 6.4: Case Study 1- Summary Of Themes Derived For Staff Preparedness From Three Different Participants Involved.

<b>Theme</b>	<b>Staff</b>	<b>Management</b>	<b>Students</b>
Understanding	<ul style="list-style-type: none"> <li>- Confusion over definition of Problem-Based Learning</li> <li>- Not clear</li> </ul>	<ul style="list-style-type: none"> <li>- Confusion over definition of Problem-Based Learning</li> <li>- Not clear on adoption</li> </ul>	<ul style="list-style-type: none"> <li>- Based on individual interpretation</li> <li>- Resulting confusion over pbl adoption</li> </ul>
Training	<ul style="list-style-type: none"> <li>- 1 day training</li> <li>- Only for selected staff only</li> <li>- No continuous training</li> </ul>	<ul style="list-style-type: none"> <li>- Only for selected staff only</li> <li>- No proper planning for training</li> </ul>	<ul style="list-style-type: none"> <li>- To improve teaching skill</li> <li>- To improve communication skill</li> <li>- To improve facilitation skill</li> </ul>
Leadership	<ul style="list-style-type: none"> <li>- No proper leader appointed</li> <li>- No supervision from institution</li> <li>- No clear direction given</li> </ul>	<ul style="list-style-type: none"> <li>- Absent of leader</li> <li>- No monitoring</li> </ul>	
Staff Attitude	<ul style="list-style-type: none"> <li>- Individual initiative</li> </ul>	<ul style="list-style-type: none"> <li>- Negative perception</li> <li>- Rejection from staff</li> </ul>	<ul style="list-style-type: none"> <li>- Based on staff initiative and style</li> <li>- Staff who possess positive attitude manage to adopt the al positively</li> </ul>
Support	<ul style="list-style-type: none"> <li>- Insufficient support from management and colleagues</li> <li>- Lack of motivation</li> <li>- No written guideline available</li> </ul>		<ul style="list-style-type: none"> <li>- No guideline given</li> </ul>
Facilities	<ul style="list-style-type: none"> <li>- Insufficient facilities provided for AL adoption</li> </ul>	<ul style="list-style-type: none"> <li>- Insufficient facilities available</li> </ul>	
Learning culture	<ul style="list-style-type: none"> <li>- Influence from previous learning approach which is teacher-centered</li> </ul>	<ul style="list-style-type: none"> <li>- Influence from previous learning culture</li> </ul>	
Planning	<ul style="list-style-type: none"> <li>-</li> </ul>	<ul style="list-style-type: none"> <li>- Ad-hock implementation</li> </ul>	
Communication	<ul style="list-style-type: none"> <li>-</li> </ul>	<ul style="list-style-type: none"> <li>No proper platform for discussion</li> </ul>	

Thus, the outcome of Case Study 1 shows lack of training as the main causal of the problems arising during implementation. In addition to this, several other factors such as the role of management and staff attitude play a major part in a better prepared situation.

Thus, as the analysis conducted was based on three different stakeholders, findings and analysis done are triangulated by using multiple evidence, namely face-to-face interviews as the main source, focus groups and document analysis. Hence, this situation provides a different perspective and valuable insight on the issue discussed and reflects on the actual AL implementation situation at PBL Institute.

### **6.3 Analysis of Findings for Case Study 2**

This section will analyse the findings from Case Study 2 which involved the WBL Institute.

#### **6.3.1 Demographic Analysis of Case Study 2**

For Case Study 2, a total of 30 participants are recorded in the interview session, 17 mentors make up the staff participants and total of 13 participants are recorded from the management level.

Based on demographic findings in Chapter 5, Table 6.5 summarises the analysis of the participants.

Table 6.5: Analysis of Staff's and Management's Demographic

<b>Participants</b>	<b>Staff (17)</b>	<b>%</b>	<b>Management (13)</b>	<b>%</b>	<b>Total (30)</b>	<b>%</b>
1. Highest education level						
Certificate	1	6	3	23	4	13
Diploma	7	41	4	31	11	37
Advance Diploma	4	24	0	0	4	13
Bachelor Degree	5	29	2	15	7	24
Masters Degree	0	0	3	13	3	10
PhD	0	0	1	8	1	3
2. Background in Biomedical						
None	11	65	9	69	20	67
Biomedical graduate	6	35	4	31	10	33
3. Total Working Experience						
< 2 years	1	6	0	0	1	3
More than 2 to 5 years	3	18	0	0	3	10
More than 5 to 10 years	3	18	0	0	3	10
More than 10 to 20 years	5	29	9	69	14	47
More than 20 year	5	29	4	31	9	30
4. Working Experience in Current Company						
< 2 years	1	6	0	0	1	3
More than 2 to 5 years	5	29	1	8	6	20
More than 5 to 10 years	3	18	2	15	5	17
More than 10 to 20 years	8	47	9	69	17	57
More than 20 years	0	0	1	8	1	3
5. Experience in WBL approach						
Never	16	94	13	100	29	97
WBL graduate	1	6	0	0	1	3

The following explanation will continue the analysis based on the category of the participants or stakeholders. From the findings in Chapter 5, the staff in Case Study 2 are also known as 'Mentors'. Thus, the following analysis will use the term 'mentor' to refer to staff involved within the AL used.

### **6.3.1.1 Mentor**

In general, analysis shows that the majority of participants possess at least a diploma with the majority of them graduating from non-biomedical courses which relate to the AL employed. With regards to the participants' working experience, only one participant is recorded to have freshly graduated before becoming employed at WBL premises as compared to other staff who possess at least 2 years of experience in the field. The involvement of the newly graduated staff as a WBL mentor is good exposure for the staff personally, as it indirectly gives an opportunity to get involved in the WBL activity at an early stage. This helps develop his mentoring skills in addition to performing daily tasks assigned to him. Thus, the variation in different working experience found among participants provides a variety of information regarding the staff preparedness with regards to WBL implementation. In addition to this, it can be observed that more than 50% of the mentors involved in this WBL are senior staff which possess more than 10 years of working experience, especially in a biomedical line. Hence, the mentors' background and experience can be seen as an important element that contributes to their involvement in WBL activity.

### **6.3.1.2 Management**

With regards to their educational background, there are few participants who just possess a Certificate or Diploma but hold a management position, as shown in Table 6.5. Analysis shows that these are mainly normal staff from the industry who have been promoted to hold a management position whilst also holding a senior position in the company. As compared to participants that possess a Bachelor degree and above, these participants are mainly management who are from the WBL institute and Company X. Hence, it shows that management who are involved as 'decision makers' possess better educational backgrounds compared to management involved at an implementation level. With regards to working experience, the majority of participants who possess more than 10 years of working experience are mainly from the industry. While most of the participants have never experienced a WBL approach before, it is interesting to know that most management involved in this WBL implementation manage to work together in order to achieve proper WBL implementation.

### 6.3.1.3 Students

For Case Study 2 a total of 19 students were involved at 7 different sites as recorded in Chapter 5.

Table 6.6: Analysis of Focus Group Demographic

<b>Group</b>	<b>Male</b>	<b>Female</b>	<b>Total</b>
CS2-Std1	1	3	4
CS2-Std2	0	2	2
CS2-Std3	2	1	3
CS2-Std4	2	0	2
CS2-Std5	2	1	3
CS2-Std6	2	1	3
CS2-Std7	1	1	2
Total	10	9	19
%	53	47	-

Analysis from the demographic table in Chapter 5 shows that the distribution of students over the different premises is not uniform. This is due to the availability of vacancies at related premises being different. In addition to this the allocation of students is arranged by the WBL coordinator from Company X which reflects on the requirement of staff at different premises. Analysis also shows that the allocation of students is based on the hospital category, more students are allocated at the main hospital as compared to district hospitals due to the inability to provide proper and related facilities at these premises as required for WBL students. It is also understood that the number of students allocated at different sites are at the maximum number that can be offered as agreed with the Team Leader from each site.

In general, the number of participants across the focus groups are almost equal with regards to gender as per Table 6.6. This situation is common within Malaysian higher institutes. With regard to this case study, a higher number of male students is recorded, however the distribution of students within each focus group is not equal

based on gender. Thus, based on Table 6.6, some groups consist of only female or only male students. With regards to this issue, one Team Leader highlighted that they are expecting to receive more male students from WBL as he believed that male students work better in the engineering field especially in a field that involves machine maintenance.

*“What I can see now is there are too many females in the course and it's very hard to get male candidates.”*

CS2-Mg1

### **6.3.2 Perception of WBL Implementation**

#### **6.3.2.1 Mentor and Management**

With regards to WBL implementation, analysis shows that the majority of management and mentors are sceptical during initial implementation. This situation triggers dissatisfaction among mentors when the information on WBL implementation was delivered to them during the initial stage. As the mentors believe that the teaching process is the responsibility of the lecturers in higher institutes, the idea of WBL implementation was not easily accepted by related staff from industry. As few series of introductions of the WBL implementation has been conducted and briefed, the implementation has initially placed the first WBL students at a few sites in 2012.

However, the mentors' perception changed after they witnessed the advantage of the WBL program which managed to produce workers with competences parallel with the demand of the industry. Since then, the majority of participants possess positive perceptions with regards to WBL implementation as most of them appreciate/acknowledge that this approach helps the students to learn effectively whilst preparing them for real working life, whereas the previous educational approach required graduates to learn and explore by themselves.

With regards to participants' awareness of WBL implementation, analysis of the findings revealed that some of the participants are only aware about the WBL approach after a few batches of students completed their attachment at their premises. The majority of mentors still consider these WBL students just like other students who come for normal industrial attachment. This situation results from improper information being shared among staff as findings also show that only selected staff are well-briefed on

this implementation. In addition, the information on WBL has been shared verbally among staff without proper information being given to them.

### **6.3.2.2 Students**

The analysis of findings in Chapter 5 shows that most of the students are happy with the approach embedded in their course as they believe this approach helps them to be prepared for real working conditions, especially directly related to the course taken. Analysis also shows that these students expressed their appreciation about being selected to be involved in the WBL approach as the implementation has given them a valuable experience, unlike previous industrial training that they attended. According to them, this WBL approach is organised in a way that the students can benefit from each activity that they experience at related premises.

With regards to students' awareness of the WBL approach used, analysis shows that the majority of the students have never heard about WBL before and they are only aware that the approach is a compulsory requirement to the course that they enrolled on. As a result, the majority have an assumption that a WBL approach is similar to the previous industrial attachment that they had, only longer in duration. The majority of students only understand the WBL approach after they experience the approach themselves.

### **6.3.3 Perception of Preparedness in WBL Implementation**

#### **6.3.3.1 Mentor and Management**

With regards to mentors' perception of preparedness, analysis shows that the majority of them believed that the mentors are prepared to implement the WBL approach based on their ability to handle the students' internship program that has been frequently attached to their sites before. In addition, they also believe that the WBL approach is similar to normal industrial attachment and hence it gives confidence to the staff about their ability to handle these WBL students.

With regards to the WBL implementation, most of participants believe that their daily routine really helped them to conduct the approach as the mentor is sometimes required to perform some training internally which, according to them, is similar to a 'teacher' function. Thus, as the WBL approach required them to handle and guide the

students, their previous experience does help the mentors to indirectly prepare for the approach.

Further analysis on the mentor's preparedness will be discussed in detail in the following section.

### **6.3.3.2 Students**

From the student's perspective, analysis from findings in Chapter 5 shows that the students believe that the staff do not have a major problem in performing the WBL approach as the mentors are 'teaching' them in their routine as technical staff onsite. The majority of the staff possess significant experience in the field, hence, the students reveal that the staff do not possess any problem with regards to WBL implementation. The mentors' dedication towards the approach has shown that they are committed to the task given to them despite their hectic daily routine in the company.

The following section will explain in detail the themes that have been analysed with regards to the staff preparedness.

### **6.3.4 Analysis of the Themes for Case Study 2**

Based on the findings themes observed in Chapter 5, analysis will be done from three different stakeholders as per findings. It is done in such a way to avoid any repetition and duplication on the issue analysed. Thus, the exploration of the analysis is based on Table 6.7 below.

Table 6.7: Summary of the Themes Derived from Participants

Themes	Mentor	Management	Students
1. Understanding	√		
2. Unclear role / direction	√		
3. Unclear WBL syllabus	√		
4. Attitude	√	√	√
5. Skill	√	√	
6. Communication	√	√	
7. Experience		√	√
8. Knowledge		√	√

#### 6.3.4.1 Theme 1: Understanding

With regards to WBL implementation, this theme emerges as highlighted by the mentors which indirectly shows how crucial it is for them to understand what WBL means in order for them to prepare as a mentor. Hence, by having a good understanding of WBL, it indirectly provides a clear picture on the approach used and how the mentor should react on it.

From initial analysis, the majority of participants who understand the term WBL well are those who attended the training conducted during the initial stage. Other participants possess different understanding as they received the information regarding WBL verbally from their superior. Thus, a different understanding is achieved due to the different interpretation given by their leader as well as their peers with regards to WBL implementation.

Further analysis from findings in Chapter 5 also found that some of the participants who possess a good understanding regarding WBL graduated from the same course and possess industrial experience in the same area. For example, one mentor who graduated from the first batch possesses a better understand about WBL.

With regards to this theme, the analysis shows that the variety of understanding about the WBL approach is due to lack of training and proper explanation regarding WBL itself. It is also understood that the training was only done during the initial stage and was attended by selected staff. Only one additional training opportunity for the mentors after the initial launch was recorded.

*“So, if you want us to do this program, they should send us for courses. So, maybe 1 or 2 days course for that for all mentors and explain about WBL particularly”*

CS2-S7

Thus, it is important for the mentor to acquire a good understanding of WBL itself, as they will then possess a better understanding of their role in WBL which will enable them to deliver their task during the WBL activity.

#### **6.3.4.2 Theme 2: Unclear Direction / Role**

In close connection with the previous theme, most of the mentors reveal that they are not sure of the direction of WBL as the majority of the mentors hold assumptions that the WBL approach is just an activity similar to a normal industrial attachment or internship. As initial training only involved a few selected staff, the briefing done by their management seems to be insufficient for the mentors to know in detail their role in WBL. This is due to the information being given mainly during morning briefing or roll-call.

In addition to this, further analysis found that most of the preparation regarding WBL was discussed and prepared between both management teams at headquarters. Only after mutual agreement was achieved by both parties does the involvement of these mentors start, when the students were allocated at their premises. Thus, the clear picture of WBL implementation was not properly communicated to the mentors as they mainly received an order to implement the approach. Hence, the mentors are not properly briefed on the correct way to implement WBL which makes them unsure of the expectation from the WBL activity

*“I was not briefed on the mentoring in a correct way, so I'm not sure what is their expectation from me as a mentor.”*

CS2-S8

#### **6.3.4.3 Theme 3: Unclear WBL Syllabus**

With regards to this theme, analysis also shows that the majority of participants depend on the schedule given to the students which indicates the competence that the students need to gain from the WBL sessions (based on the list of equipment required). In addition, the majority of the mentors were not aware that there is a syllabus available for them in order for the mentors to refer to the competences required. This is mainly due to improper briefing regarding the WBL approach.

In addition, the majority of participants expressed concern about this situation as the mentors believed that the knowledge received by the students varied based on mentors' experience and knowledge. Thus, it is believed that the availability of the syllabus will help the mentor to be better prepared and know what and how they are supposed to teach and mentor the students.

*“For them (mentor), they do not know about the syllabus, exam and test. They just depend on the schedule given.”*

CS2-S11

Apart from this, the condition has also been highlighted by the management team in Chapter 5 as one of the challenges faced by the mentors in implementing WBL. Further analysis also shows that some of the team leaders are not aware of the availability of the syllabus as they are among newly appointed team leaders and were not involved in WBL during the initial stage.

#### **6.3.4.4 Theme 4: Attitude**

With regards to this theme, all participants in each group agreed that a mentor's attitude has a significant impact in preparing the mentor for the WBL approach. By considering that these mentors used to receive other students to do the industrial attachment, this WBL approach is adding an additional task for them as they are required to perform specific actions during the WBL activity. Thus, most of the participants highlighted that the willingness of the mentor to guide and coach the students during WBL is important as not many of them are willingly to do an extra task given to them. Thus, one of the suggestions made by the participants is to have proper validation of mentors in order to qualify them to be a proper and prepared mentor.

*“I think we need to make sure either the mentor is really qualified to be a mentor or as a teacher”*

CS2-S8

However, based on the frequency analysis done from the management’s interview as shown in the Figure 6.4, this theme is the least frequently discussed among them. However, the majority of the management agreed that this theme plays a major role in preparing the staff to implement the AL.

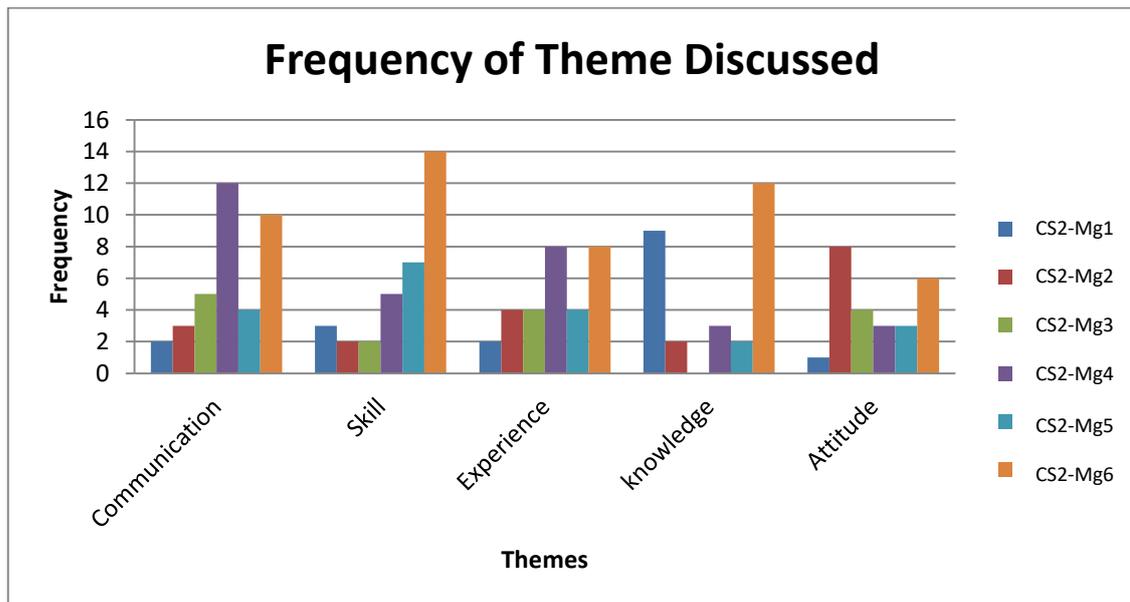


Figure 6.4: Frequency Analysis for Management

#### 6.3.4.5 Theme 5: Skill

Regarding this theme, both mentors and management highlight that skill is an important attribute that all the staff should possess in order to be a prepared mentor. This can be seen in Figure 6.4 where this theme was the second most frequently discussed theme during the interviews.

From the point of view of the staff, as the WBL approach required the mentor to be a ‘teacher to the students’, they believe that appointed mentors manage to do the teaching but, as teaching is not their main task, they did not perform as well as a proper lecturer in university. Thus, in order to be a proper teacher, they required related training such as pedagogy to be given to all mentors.

While initial findings revealed that pedagogy training was conducted at the initial stage, it is also understood that the training was conducted for selected staff and no other training was scheduled after that. Obviously, new staff as well as other staff who are involved as WBL mentors were not included in the training as the last pedagogy training conducted was in 2012, after it was initially launched in 2010. This shows that insufficient training was given to the mentors in order to prepare them as WBL mentors.

*“In terms of their experience on hands-on, I have no doubt on them but in terms of to be a good teacher, I think they are not good enough yet. They need more training and other things as well because they are not trained here to be a lecturer.”*

CS2-Mg6

With regards to other training that involved technical and communication skills, a few training series conducted by the company are recorded as the mentors' position required them to have necessary skills to perform their daily tasks as well as proper communication skills to deal with their user. Thus, findings show that mentors who attended this training possess the necessary technical skill which allows them to deliver the necessary information to the students during the WBL activity. In addition, findings also reveal that they manage to convey the information well to the students as most of the mentoring session is believed to be conducted using spoken word in the local language (Malay language) which is understood by both parties. However, the use of local spoken language among the students and mentors is seen to be a disadvantage to both mentors and students as the majority of the mentors are barely able to speak English fluently as highlighted in Chapter 5.

#### **6.3.4.6 Theme 6: Communication**

Findings from Case Study 2 highlights that communication is an important factor in conducting this WBL approach as it involved multiple parties, namely the medical industry, education sector as well as top management from both sides. The importance can be seen as this theme was the main concern discussed by the management during the interviews as shown in Figure 6.4. In the case of the WBL approach, the activity required involvement from related parties where the information should be properly addressed and the information be well-received. It is understood that any communication between the Company X and WBL institute is done between appointed representatives, also called Coordinators. Thus, these representatives are responsible

for any communication regarding WBL and any information is agreed to be channelled through the appointed representatives. In the case of Company X, any information received from the WBL Institute coordinator, CS2-Mg10, is conveyed through CS2-Mg12 (please refer to Chapter 5). CS2-Mg12 will then distribute the information to CS2-Mg7 and CS2-Mg8 who are Region Coordinators that monitor multiple sites (hospitals) in different states in the northern region of Malaysia. From there, the information is distributed to related sites (hospitals) which is mainly to Team Leaders on each site. The information is then shared among mentors and staff by their Team Leader either through a meeting or during roll-call.

Thus, it is important to have a proper system of communication in place as the information received should be clear and efficient. In the case of this WBL activity, the communication is important especially for the students' assessment where it is done periodically, the exam sheets are controlled by CS2-Mg12 at headquarters and are only distributed a few days before the test is scheduled. Thus, any information regarding WBL activity is crucial and proper communication helps mentors to prepare and perform related tasks as required.

#### **6.3.4.7 Theme 7: Experience**

With regards to this theme, participants from the management and students strongly agreed that mentor's experience contributes to their preparedness in WBL implementation. As one of the mentors' tasks is to guide and coach during the technical work, their experience in the line helps them to deliver and teach necessary information to the students. In addition to this, the analysis in Table 6.5 shows that more than 70% of mentors involved in this case study possess more than 5 years of experience and more than half of them possess at least 5 years of experience in the biomedical field. As mentioned by one of the team leaders, he also agreed that the majority of the senior staff who possess more experience in the field manage to prepare and perform better as WBL mentors as compared to junior staff.

*".. majority of my staff are considered senior staff, so they are considered an expert in their area and I think they don't have any problem to deliver to the students but it also depend on the student."*

CS2-Mg3

In addition to this, it is also understood that the majority of the mentors selected possess adequate experience as a trainer internally. As one of the mentors' task is to provide user training, mainly to the hospital staff, this activity indirectly prepared them to be a teacher to the WBL students as their routine in delivering the training is similar to delivering the knowledge during the WBL activity. Hence, their capability is indirectly linked to their experience gained through work.

*“User training also involves doctors as well. So, for me, to teach these diploma students, I don't think it's a problem because the preparation is there.”*

CS2-S16

Apart from this, a mentor's experience in handling students who attended industrial attachment helps them and indirectly prepared them to be a better mentor. Thus, the majority of appointed mentors who possess adequate experience in dealing with the students, responded positively about their ability to perform their task as a mentor in the WBL approach.

#### **6.3.4.8 Theme 8: Knowledge**

Related to the previous theme, participants from management and students also agreed that this theme helps better prepare mentors for the WBL activity. As these mentors are not only required to have good technical knowledge in dealing with the medical equipment, feedback from participants also revealed that mentors are required to have adequate theoretical knowledge on the equipment as well as clinical knowledge. Thus, there is a concern raised by some participants where some senior staff who possess experiences in the industry do not necessarily possess good knowledge as the majority of them graduated from a different background. This is unlike junior staff, the majority of whom graduated in courses related to the biomedical field. Hence, it is crucial for mentors to possess necessary knowledge in the related field in order for them to be a knowledgeable mentor.

*“Seniors staff who were not from a biomedical field, they do not have clinical knowledge, so it is important for them to have a good foundation in that area.”*

CS2-S16

On the other hand, there is a concern raised by senior staff about the technical knowledge among junior staff who are involved as mentors in the WBL activity. This is due to their insufficient work experience in the company as well as inadequate training given to them.

*“Another group who graduated in the biomedical field, I don't see any problem that they face in his field because they had learned everything in their university. They are OK with theory but some of them need to improve their technical knowledge.”*

CS2-S16

Thus, there is a concern raised by participants regarding checking the capability of staff to be a mentor by conducting an assessment. The majority of the mentors believe that most staff are able to become mentors but there is little concern about how prepared the mentor is for the approach and if they manage to perform effectively.

*“I think we need to make sure that the mentor is really qualified to be a proper mentor or as a teacher.”*

CS2-S8

### **6.3.5 Document Analysis for Case Study 2**

As documents analysis is used to triangulate the findings in each case study, few documents have been retrieved throughout the interview and focus group sessions. Documents such as academic schedules, assessment sheets, frameworks, curriculum procedures and course content are among the main information referred to during the interview sessions with the staff as well as during focus groups with the students. These documents were retrieved in order to check and confirm the availability of the document as well as to validate the findings.

In addition, other documents that are mainly procedures and meeting records are retrieved during management interviews for evidence purposes. However, due to some confidential issues, the researcher is only able to view some of these documents during the interview sessions and no copies were allowed to be made.

Overall, most of the important documents regarding WBL are available for reference and evidence of training can be retrieved and well-kept by the relevant person in charge. Most importantly, a copy of all relevant documents has been given

to each Team Leader at each site for their reference as well as a file which contains a copy of all of the documents. However, analysis of findings from this case study show that only some participants are aware of the existence of these documents as only selected mentors attended the training and briefing conducted by WBL Institute.

### 6.3.6 Summary of Case Study 2 Analysis

Based on the analysis conducted on multiple forms of evidence, namely data collected from face-to-face interviews as the main source, focus groups and document analysis, it is found that the staff believed that they were prepared to perform the WBL approach as instructed by their top management. Table 6.8 shows the summary of finding the conclusions of the analysis done.

Table 6.8: Case Study 2- Summary of Themes Derived for Staff Preparedness from Three Different Participants Involved.

<b>Theme</b>	<b>Staff</b>	<b>Management</b>	<b>Students</b>
Understanding	<ul style="list-style-type: none"> <li>- Confusion over practical attachment</li> <li>- Not clear</li> </ul>	-	-
Unclear Direction	<ul style="list-style-type: none"> <li>- Lack of awareness</li> <li>- Role as mentor</li> </ul>	-	-
Unclear Syllabus	<ul style="list-style-type: none"> <li>- Unsure on availability</li> <li>- Based on initiative</li> </ul>	-	
Attitude	<ul style="list-style-type: none"> <li>- Individual initiative</li> </ul>	<ul style="list-style-type: none"> <li>- Individual initiative</li> </ul>	<ul style="list-style-type: none"> <li>- Individual initiative</li> </ul>
Skill	<ul style="list-style-type: none"> <li>- Sufficient technical skill but,</li> <li>- Lack of communication skill</li> <li>-</li> </ul>	<ul style="list-style-type: none"> <li>- Sufficient technical skill</li> <li>- Lack of teaching skill</li> <li>- Lack of communication skill</li> </ul>	
Communication	<ul style="list-style-type: none"> <li>- Proper system available</li> </ul>	<ul style="list-style-type: none"> <li>- Proper system available</li> </ul>	
Experience	-	<ul style="list-style-type: none"> <li>- Senior staff as WBL mentor</li> <li>- Similar to internship program</li> </ul>	<ul style="list-style-type: none"> <li>- Working experience (Similar mentor-mentee program)</li> </ul>

Knowledge	-	- Sufficient technical knowledge - Sufficient theoretical knowledge	- Sufficient technical knowledge - sufficient theoretical knowledge
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However, detailed analysis shows that the preparedness is only based on their own interpretation as the WBL approach conducted is similar to their regular job and daily tasks. This is due to the fact that the staff admitted that inadequate training about the WBL approach triggered different perceptions on the WBL activity among mentors. In addition, the majority of the mentors are unsure if their perception of WBL is achieved and aligned with the purpose of the WBL activity itself. This is consistent with findings where there is lack a of awareness of the training given to them as only selected mentors attended training for the WBL implementation. In addition, the majority of the mentors are unaware of the existence of the WBL syllabus which indirectly reveals that the mentors do not provide sufficient mentoring and coaching to the students. Furthermore, a suggestion to assess the staff in order to validate them as a certified mentor is seen to be a practical solution in order to make sure the staff are qualified as a prepared mentor.

However, from the point of view of the management and the students, the majority of participants believe that the mentors are prepared to implement the approach as per requirements where the themes derived from the findings from both stakeholders are found to be coherent.

## 6.4 Cross-Case Analysis

This section will analyse the findings from both case studies conducted. Hence, the analysis is to observe similarities and differences found between the two case studies.

### 6.4.1 Demographic Analysis

In doing this research work a total of 54 participants are recorded participating in the interview sessions which involved staff and management level, while 59 students were involved in the focus groups carried out.

### 6.4.1.1 Staff and Management

Table 6.9 presents the summary of the analysis from the demographic data of the participants from the staff and management level who were involved in the interview sessions from both case studies conducted for this research work.

Table 6.9: Analysis of Staff's and Management's Demographic

Participants	Staff (Mentor)		Management		Total	%
	Case Study 1	Case Study 2	Case Study 1	Case Study 2		
1. Highest education level						
Certificate	0	1	0	3	4	7
Diploma	0	7	0	4	12	22
Advance Diploma	0	4	0	0	11	20
Bachelor Degree	7	5	0	2	12	22
Masters Degree	13	0	4	3	20	37
PhD	0	0	0	1	1	2
2. Total Working Experience						
< 2 years	1	1	0	0	2	4
More than 2 to 5 years	2	3	0	0	5	9
More than 5 to 10 years	5	3	0	0	8	15
More than 10 to 20 years	11	5	1	9	26	48
More than 20 year	1	5	3	4	13	24
3. Experience in AL approach						
No	18	16	2	13	49	91
Yes	2	1	2	0	5	9
4. Total Working Experience at current institute						
< 2 years	2	1	0	0	3	6
More than 2 to 5 years	5	5	0	1	11	20
More than 5 to 10 years	10	3	0	2	15	28
More than 10 to 20 years	2	8	2	9	21	39
More than 20 years	1	0	2	1	4	7

With regards to participants' educational background, it can be seen in Table 6.9 that staff in Case Study 1 possess better qualifications as compared to the participants in Case Study 2. This condition is due to the requirement for staff in the education sector to possess at least a Degree in order to be in a teaching position. Thus, there are no staff in Case Study 1 that hold a qualification lower than a degree, as compared to participants in Case Study 2 where only a minority of the participants possess a degree qualification, some possess a Diploma and Certificate from related engineering fields. The situation in Case Study 2 is due to the condition where the

experience of the staff is valued in addition to the academic qualification that they have. The same pattern can be seen for the management participants where management in higher education possess at least a Master Degree as compared to management in industry who possess lower qualifications but have more experience in related fields.

With regards to the participants' experience in industry, the majority of the participants in the staff (mentor) category from both case studies possess more than 5 years work experience. In addition, it can be seen that more than 50% of the participants are considered as experienced staff as they possess more than 10 years of work experience. Meanwhile, most of the participants in the management category possess at least 10 years of work experience. Some of the participants in this category possess more than 20 years of work experience which indirectly qualifies them to be a leader in their institute.

With regards to participants who have had experience in AL implementation before, only 1% of participants from the staff category experienced an AL approach during their study as the majority of other participants graduated from courses which employed teacher-centred education. Thus, the variety of participant backgrounds provides different perceptions of AL implementation for this research work. Therefore, the analysis of the findings leads to meaningful findings as the results find similar themes as well as some dissimilarities regardless of different AL approaches chosen.

#### **6.4.1.2 Students**

In doing this research work, a total of 59 participants are recorded participating in the focus group sessions. Table 6.10 presents the summary of the demographic analysis from the focus group interviews involved in this research work.

Table 6.10: Analysis of Focus Group Demographic

Participants Group	Case Study 1		Case Study 2	
	Male	Female	Male	Female
01	4	1	1	3
02	5	0	0	2
03	3	2	2	1
04	2	3	2	0
05	4	1	2	1
06	2	3	2	1
07	5	0	1	1
08	5	0	0	0
Total	30	10	10	9
%	75	25	53	47

Based on Table 6.10, analysis shows that there are more male students participating in this research work in both case studies. This shows that more male students are enrolled in engineering courses as compared to female students at both case study institutes.

## 6.4.2 Perception of AL

### 6.4.2.1 Staff and Management

With regards to the staff perception in AL implementation, analysis done reveals that both case studies show sceptical feedback during the initial stage. However, the acceptance of the staff in Case Study 2 improves as compared to the feedback given by the staff in Case Study 1. Despite seeing positive changes among the students after AL implementation at the PBL Institute, the staff still possess negative perceptions due to several factors as highlighted in findings in Chapter 4. Further analysis will be discussed in the following section.

With regards to staff awareness in AL implementation, analysis shows that the staff awareness in Case Study 2 is better than for the staff in Case Study 1. Findings from Case Study 2 revealed that the information regarding the AL used is disseminated better among staff in Case Study 2 as compared to staff in Case Study 1.

### 6.4.2.2 Students

With regards to the students' perception in AL implementation, students in Case Study 2 possess better perception as compared to students in Case Study 1. This is

due to the positive situation experienced by students in Case Study 2 with regard to the AL employed by them. As compared to students in Case Study 1 where most of the negative responses are due to the negative experience caused by the AL employment not being properly done at their institute.

### **6.4.3 Perception on Preparedness**

#### **6.4.3.1 Staff and Management**

Regarding the staff preparedness, analysis from findings shows that the staff in Case Study 2 are said to be at 'prepared' condition as compared to the staff in Case Study 1. This is due to the fact that the AL adopted in Case Study 2 is similar to the staff's daily routine which indirectly helps them to prepare for the approach used. In addition, most of the staff participating in Case Study 2 are senior staff who have more experience in the related field as compared to the staff in Case Study 1. For instance, the majority of the staff in Case Study 2 possess more than 10 years of experience as compared to the staff in Case Study 1. While the staff in Case Study 2 gain the benefit of having a similar routine to the AL used, the staff in Case Study 1 struggle to adopt the chosen AL which according to them is considered a new approach to be implemented.

#### **6.4.3.2 Students**

With regards to staff preparedness, the majority of students in Case Study 2 are confident that the staff are ready to implement AL as they believe the staff's own experience contributes to their preparedness in implementing the chosen AL. In contrast, a mixture of responses from the students in Case Study 1 shows that the staff preparedness varies as the students possess mixed feelings with regards to the staff preparedness for the implemented AL. This is due to their various experience of the AL implementation at their institute.

### **6.4.4 Analysis of the Themes**

With regards to the staff preparedness, Table 6.11 summarises the themes found from both case studies. It can be seen that some of the themes are shared by both case studies. Thus, further analysis will be based on the similarities and the differences of the individual themes.

Table 6.11: Analysis of the Themes Derived from Both Case Studies

Themes	Staff		Management		Students	
	Case Study 1	Case Study 2	Case Study 1	Case Study 2	Case Study 1	Case Study 2
1. Understanding	√	√	√		√	
2. Staff Attitude	√	√	√	√	√	√
3. Communication		√	√	√		
4. Support	√				√	
5. Planning			√			
6. Leadership	√		√			
7. Facilities	√		√			
8. Learning Culture	√		√			
9. Facilitation					√	
10. Training	√		√			
11. Unclear role / direction		√				
12. Unclear WBL syllabus		√				
13. Skill		√		√		
14. Experience				√		√
15. Knowledge				√		√

#### 6.4.4.1 Similarities Among Cross-Case Studies

##### 6.4.4.1.1 Understanding – Different Understanding

Based on this theme, the majority of participants in the staff category revealed that they do not possess a good understanding of the AL employed by them. Some of them also revealed misunderstandings about the approach used which is mainly due to not enough training being given to them. Only some of the participants from both case studies exhibit a good understanding and perform the AL as per requirement. In addition to this, analysis for the theme shows that participants from the management

level as well as the students in Case Study 1 highlighted this theme as being an important factor in the implementation. Thus, it can be seen that participants in Case Study 1 possess a lack of understanding as compared to participants in Case Study 2. Hence, this condition indirectly reflects on preparation as well as how the information regarding the AL approach is conveyed to relevant parties within each case study.

#### **6.4.4.1.2 Staff Attitude**

With regards to this theme, all participants in each category from both case studies agree that the staff attitude is an important factor in AL implementation. Findings from both case studies prove that staff/mentors who possess positive attitude are willing to adopt the AL approach and will try their best to implement the AL as required. In addition, the staff that possess a positive attitude use their own initiative to better prepare themselves and find related information by themselves, not just depending upon management to provide related training. From the management perspective, staff attitude is an important factor as this theme will reflect how successful the implementation is at each institute where staff who possess a positive attitude will support the implementation by getting positive feedback from the students on the implementation.

From the point of the students, the staff attitude will influence their experience with the staff during learning & teaching sessions. Thus, the better the staff perform during the session, the more easily the students are attracted to the session and remember how well the session is done. In other words, staff attitude will reflect on how the students describe their teacher with the approach applied.

#### **6.4.4.1.3 Communication**

Regarding this theme, it has been highlighted by management in both case studies that communication plays a major role in staff preparedness. Responses from staff in Case Study 2 reveal that they are always being updated with information regarding the implementation unlike staff in Case Study 1 who reveal a lack of communication regarding implementation. It is clearly understood that good communication among all levels will direct the staff to prepare correctly in order to achieve successful AL implementation.

## **6.4.4.2 Differences Among Cross-Case Studies**

### **6.4.4.2.1 Support**

Table 6.11 shows that only participants from Case Study 1 reveal that they do not receive appropriate support in AL implementation. This is parallel to the findings where most of the participants possess a negative perception with regards to AL implementation. Unlike participants (mentors) in Case Study 2 who are happy with the support given by their management and believe that support is important in order to make sure the AL implementation is run as per expected.

### **6.4.4.2.2 Planning**

This theme is highlighted by the management from Case Study 1 only, where they admit that improper planning has caused improper implementation of AL at their institute. Findings also revealed that the implementation of AL in Case Study 1 was only given 6 months for preparation prior to implementation, whilst in Case Study 2 it took almost 2 years of preparation which involved all relevant parties. Thus, improper planning does affect the implementation in the long run, as evidence revealed in Case Study 1 where some of the staff refuse to continue to adopt the approach as required due to their unpreparedness.

### **6.4.4.2.3 Leadership**

Improper leadership to manage the implementation has caused improper implementation. With regards to Case Study 1, the leader was recently appointed (in 2014) and the implementation was not properly addressed and monitored. In contrast, in Case Study 2 there is a proper hierarchy in conducting and monitoring their AL implementation and all related persons in charge are aware of their responsibilities with regards to the AL implementation.

### **6.4.4.2.4 Facilities**

Whilst not emerging as a theme in Case Study 2, this theme is highlighted by participants in Case Study 1 as they believe the facilities provided to them are not sufficient for them to employ the AL as required. In addition, they also found that the

facilities given do not match with the requirement to run the AL approach within the institute.

#### **6.4.4.2.5 Learning Culture**

Analysis from the findings reveal that responses from Case Study 1 highlight that their previous teacher-centred approach indirectly leads to improper implementation as the students prefer to be spoon-fed by the teacher while the teacher tends to provide the answers instead of encouraging the students to find the information by themselves. This opinion has also been raised by some of the mentors and management in Case Study 2 as they are concerned that the students should be more pro-active in finding the knowledge and should not just wait to receive information from their mentor. Thus, this factor plays an important role that needs to be considered in implementing the AL approach properly.

#### **6.4.4.2.6 Facilitation**

This is a unique theme that is highlighted by students in Case Study 1 where the staff do not know how to handle the AL approach correctly. As the feedback from findings reveal that the process of learning and teaching within the AL used was done based on the individual's initiative, obviously there is no clear guideline given to the staff in Case Study 1 on how to implement the approach.

#### **6.4.4.2.7 Training**

Analysis in Table 6.9 shows that only participants in Case Study 1 reveal this theme as an important factor that influences the staff preparedness. This tallies with the finding that the majority of participants highlighted that insufficient training was provided to them, making them unable to perform the AL implementation as per requirement. However, issues like selected staff being chosen to attend training during the initial stage are common issues raised by participants in both case studies. In addition, inappropriate information received by them is also among concerns raised due to the limited training provided.

#### **6.4.4.2.8 Unclear Role / Direction**

Analysis from findings reveal that this theme is raised by staff in Case Study 2 and found to be related to the theme 'Understanding' where the staff are unsure of how they should perform during AL implementation. In addition, insufficient information given to them has resulted in the mentors leading the sessions based on their own initiative.

#### **6.4.4.2.9 Unclear WBL Syllabus**

This theme is also related to the theme 'Understanding' and found from staff in Case Study 2. The response from the mentors revealed that they are unsure how to deliver the approach as per expectation. This is mainly due to the lack of proper information given to them particularly during the initial stage. As evidence shows that the syllabus is available to the mentor for reference, analysis shows that the majority of participants in Case Study 2 required proper training and briefing regarding the approach and the briefing should involve all staff that are appointed to be mentors for the approach.

#### **6.4.4.2.10 Skill**

This theme is unique to Case Study 2 as the AL used required the mentor to possess necessary skills in order to perform well during the AL sessions. Since the majority of the staff involved in Case Study 2 are seniors, their experience provides an advantage for them to be a prepared mentor, apart from sufficient training for them provided by the company.

#### **6.4.4.2.11 Experience**

As this theme is related to the previous theme, the participants' experience in Case Study 2 provides an advantage among the senior staff to better prepare themselves for the AL used. As the majority of the staff gain better skills from their previous working experience, the availability of training provided to them enhances their skill level particularly compared to the junior staff. The experience of the staff in Case Study 2 helps them to appreciate the use of AL as the majority agree about the advantages of AL in order to prepare the students for the work environment. However, in Case Study 1, the staff experience in industry may help them to appreciate the use

of AL adoption but are unable to help them to correctly apply the approach as they required appropriate pedagogical knowledge before adopting the AL implementation.

#### 6.4.4.2.12 Knowledge

With regard to this theme, analysis shows that the staff in Case Study 2 highlighted the importance of having necessary knowledge in order to be able to be a prepared mentor for the approach. Despite possessing good technical skill, analysis from the findings revealed that by possessing good knowledge, it indirectly built confidence in the staff in order to be a teacher during the AL sessions. This opinion has also been raised by several participants in Case Study 1 where appropriate knowledge contributes to staff confidence in dealing with the students during the AL session.

#### 6.4.5 Challenges Faced in AL implementation

Table 6.12 summarize the challenges faced Highlighted by Each Participants in Case Study 1 & Case Study 2

Table 6.12: Challenges Faced Highlighted by Each Participants in Case Study 1 & Case Study 2

Challenges	Staff		Management		Students	
	Case Study 1	Case Study 2	Case Study 1	Case Study 2	Case Study 1	Case Study 2
1. Time	√	√	√		√	
2. Workload	√	√	√	√		
3. Assessment scheme	√		√		√	
4. Increasing number of students	√					
5. Students attitude / response	√			√		
6. Inappropriate knowledge		√				
7. Staff perception			√		√	
8. Syllabus				√		√
9. Guideline for mentoring				√		

10. Guidance from staff					√	√
11. Co-operation from peers					√	

#### 6.4.6 Summary of Cross-Case Analysis

Table 6.13 summarises the practice and experience based on each case study conducted.

Table 6.13: Summary of Practice and Experience for Both Case Study

	Description	CS 1	CS2
AL Awareness	AL approach	PBL	WBL
	AL starts	Since 2010	Since 2010
	AL adoption	Every subject	During MB & PPM
	AL venue	Classroom	Hospital
	AL implementation	- individual initiative - based on individual interpretive	Compulsory
Experience in AL implementation	Student's learning style	Solving problem	Performing work
	Written guideline	No	Yes
	Training	1 day (Only for selective staff)	3 days (Only for selective staff)
	Institution supervision	No	Yes (together with WBL co-ordinator)

With regards to staff preparedness, Table 6.14 summarises the analysis of findings based on themes derived from both cases study conducted.

Table 6.14: Summary on Analysis of Findings for Both Case Study Conducted

<b>Theme</b>	<b>CS 1</b>	<b>CS2</b>
Understanding	<ul style="list-style-type: none"> <li>- Confusion over definition of Problem-Based Learning</li> <li>- Not clear</li> </ul>	<ul style="list-style-type: none"> <li>- Confusion over practical attachment</li> <li>- Not clear</li> </ul>
Training	<ul style="list-style-type: none"> <li>- 1 day training</li> <li>- Only for selected staff only</li> <li>- No continuous training</li> </ul>	<ul style="list-style-type: none"> <li>- 3 days training</li> <li>- Only for selected staff only</li> <li>- Lack of awareness on AL adoption</li> </ul>
Leadership	<ul style="list-style-type: none"> <li>- No proper leader appointed</li> <li>- No supervision from institution</li> <li>- No clear direction given</li> </ul>	<ul style="list-style-type: none"> <li>- Proper leader appointed</li> </ul>
Staff Attitude	<ul style="list-style-type: none"> <li>- Individual initiative</li> </ul>	<ul style="list-style-type: none"> <li>- Individual initiative</li> </ul>
Support	<ul style="list-style-type: none"> <li>- Insufficient support from management and colleagues</li> <li>- Lack of motivation</li> <li>- No written guideline available</li> </ul>	<ul style="list-style-type: none"> <li>- Guideline available</li> <li>- Unsure on availability of syllabus</li> </ul>
Facilities	<ul style="list-style-type: none"> <li>- Insufficient facilities provided for AL adoption</li> </ul>	<ul style="list-style-type: none"> <li>- use existing facilities</li> </ul>
Learning culture	<ul style="list-style-type: none"> <li>- Influence from previous learning approach which is teacher-centered</li> </ul>	<ul style="list-style-type: none"> <li>- Students are passive</li> </ul>
Planning	<ul style="list-style-type: none"> <li>- No proper planning</li> <li>- Only 6 moth prior to adoption</li> </ul>	<ul style="list-style-type: none"> <li>- Proper hierarchy available (involvement from all level)</li> <li>- 2 years preparation</li> </ul>
Communication	<ul style="list-style-type: none"> <li>- Lack of communication</li> <li>-</li> </ul>	<ul style="list-style-type: none"> <li>- Proper system available</li> </ul>
Skill	<ul style="list-style-type: none"> <li>- Pedagogy training given on teaching skill</li> <li>- Lack of facilitation skill</li> </ul>	<ul style="list-style-type: none"> <li>- Sufficient technical skill</li> <li>- Lack of teaching skill</li> <li>- Lack of communication skill</li> </ul>
Experience	<ul style="list-style-type: none"> <li>- Industry background does help implementation</li> </ul>	<ul style="list-style-type: none"> <li>- Working experience is advantage</li> <li>- Similar to mentor-mentee program</li> </ul>
Knowledge	<ul style="list-style-type: none"> <li>- Sufficient engineering background</li> </ul>	<ul style="list-style-type: none"> <li>- Sufficient technical knowledge</li> <li>- sufficient theoretical knowledge</li> </ul>

With regards to challenges faced in AL implementation, Table 6.15 summarises the findings of analysis on challenges face as per Case Study 1 and Case Study 2.

Table 6.15: Summary of Analysis on Challenges Face from Both Case Study

<b>Challenges</b>	<b>Case Study 1</b>	<b>Case Study 2</b>
Limited Time	- Too much syllabus to cover within time frame	- Yes. - Priority to daily task /job.
Workload	- High	- High
Assessment	- Not available Not standardised	- Available but staff not aware on the availability Standardised
Syllabus	-	- Available but staff not aware on the availability - Standardised
Student	- Higher enrolment - Passive	- Passive
Staff Attitude	- Negative perception on adoption	- Lack of awareness
Staff (Lecturer)	- Negative perception - Lack of AL knowledge - Lack of facilitation - No support from colleague	- High expectation - Lack of theoretical knowledge - Lack of facilitation

#### 6.4.7 Further Analysis

From the cross-case analysis done, the findings themes observed from both case studies as shown in Table 6.16 are further analysed and simplified into final themes. This is due to the fact that some of the themes highlighted from the two case studies can be consolidated in order to be more manageable for preparing the framework.

Based on Table 6.16, some of the themes (shown in the shaded areas) are re-arranged across the existing themes and the quantity is reduced from 15 themes to 9 themes. It can be observed that the majority of the highlighted themes are best suited under the theme 'Training'. Thus, the highlighted themes Facilitation, Unclear role/direction, Unclear WBL syllabus, Skill, Experience, and Knowledge, are consolidated into one theme *Training*. Thus, the final themes derived from both case studies are simplified as per Table 6.17.

Table 6.16: Selected Themes That Required Further Refinement

Themes	Staff		Management		Students	
	Case Study 1	Case Study 2	Case Study 1	Case Study 2	Case Study 1	Case Study 2
1. Understanding	√	√	√		√	
2. Staff Attitude	√	√	√	√	√	√
3. Communication		√	√	√		
4. Support	√				√	
5. Planning			√			
6. Leadership	√		√			
7. Facilities	√		√			
8. Learning Culture	√		√			
9. Training	√		√			
10. Facilitation					√	
11. Unclear role / direction		√				
12. Unclear WBL syllabus		√				
13. Skill		√		√		
14. Experience				√		√
15. Knowledge				√		√

Table 6.17: Final Theme Derived

Themes	Staff		Management		Students	
	Case Study 1	Case Study 2	Case Study 1	Case Study 2	Case Study 1	Case Study 2
1. Understanding	√	√	√		√	
2. Staff Attitude	√	√	√	√	√	√
3. Communication		√	√	√		
4. Support	√				√	
5. Planning			√			
6. Leadership	√		√			
7. Facilities	√		√			
8. Learning Culture	√		√			
9. Training	√	√	√	√	√	√

Based on the list of challenges faced in AL implementation as per Table 6.15, the challenges are arranged to suit the final themes derived in Table 6.17. Table 6.18 summarises the challenges based on the final themes derived.

Table 6.18: Summary of the Challenges Based on the Final Themes Derived

Challenges	Case Study 1	Case Study 2	Remark
Limited Time	- Too much syllabus to cover within time frame	- Yes. - Priority to daily task /job.	Challenge 1
Workload	- High	- High	Challenge 2
Assessment	- Not available - Not standardised	- Available but staff not aware on the availability - Standardised	
Syllabus		- Available but staff not aware on the availability - Standardised	
Student	- Higher enrolment		Challenge 3
	- Passive	- Passive	Reflected Theme: Learning culture

Staff Attitude	- Negative perception on adoption	- High expectation	Reflected Theme: Staff Attitude
Staff (Lecturer)	- Negative perception - Lack of AL knowledge - Lack of facilitation - No support from colleague	- Lack of theoretical knowledge - Lack of facilitation	Reflected Theme: Training

From Table 6.18, most of the challenges match to the final themes derived. However, a few challenges such as time, workload and increasing numbers of students are the challenges that are identified as uncontrolled factors that happen during AL implementation.

However, two challenges are identified as being an important consideration in this study, these are 'assessment' and 'syllabus' as highlighted by the shaded columns. These two challenges are considered together as 'Teaching & Learning'. These two issues have been considered together in order to embrace Biggs' Constructive Alignment Theory. Table 6.19 summarises the final themes that have been derived from this qualitative data.

Table 6.19: Summary of the 10 Themes Derives from Qualitative Study.

Themes	Staff		Management		Students	
	Case Study 1	Case Study 2	Case Study 1	Case Study 2	Case Study 1	Case Study 2
1. Understanding	√	√	√		√	
2. Staff Attitude	√	√	√	√	√	√
3. Communication		√	√	√		
4. Support	√				√	
5. Planning			√			
6. Leadership	√		√			
7. Facilities	√		√			
8. Learning Culture	√		√			
9. Training	√	√	√	√	√	√
10. Teaching & Learning	√		√	√	√	√

#### 6.4.8 Summary

In conclusion, the results from the cross-case analysis show that, some themes raised are common issues highlighted by participants in both case studies, while some other themes are unique, specifically relating to the AL approach used. However, issues with training faced by the participants seem to be a common problem raised by both case studies. Insufficient training given to the staff has led to a misunderstanding of the approach which consequently affects the staff preparedness. With regards to this situation, suggestions about conducting assessments of staff in order to validate them seems to be an effective suggestion in order to make sure that the staff are ready and competent to implement the AL as per the institutional requirement. However, other additional issues such as inappropriate support from management and an insufficient learning environment indirectly prevent the staff being better prepared for AL implementation.

Finally, the analysis in this section has also presented 10 consolidated final themes which will be used in the following chapter.

## CHAPTER 7 : QUANTITATIVE ANALYSIS AND KEY FINDINGS – COMMUNITY SURVEY

### 7.1 Introduction

The aim of this chapter is to present the findings from the quantitative work done. This chapter is the continuation from findings in the qualitative phase. This chapter starts with demographic findings based on the survey conducted. Subsequently, the following subsection presents the descriptive findings and analysis done on the data collected.

### 7.2 Demographic Data

For this quantitative work, a total of 353 engineering educators from various Malaysian higher education institutions were recorded in the survey conducted. Table 7.1 shows the summary of demographic data from the participants involved.

Table 7.1: Summary of Demographic Data

Variable	Description	Frequency	Percentage (%)
Gender	Male	186	52.7
	Female	167	47.3
Age	21-25	4	1.1
	26-30	55	15.6
	31-35	99	28.0
	36-40	96	27.2
	41-45	47	13.3
	46-50	22	6.2
	51-55	23	6.5
	56-60	7	2.0
First-degree	Engineering	292	82.7
	Non-engineering	61	17.3
Highest qualification	PhD	183	51.8
	Masters	128	36.3
	Degree	42	11.9

Based on data in Table 7.1, 52.7 % of participants are male while 47.3% are female. Regarding the age brackets, participants from the age bracket of 31-35 years recorded as the highest participants group with 28% while participants from the age bracket of 56-60 years recorded as the lowest group of participants involved in this survey. With regards to academic qualifications, the majority of participants have graduated from an engineering background based on their first degree qualification which recorded 82.7% while 17.3% participants graduated with a non-engineering degree but are currently involved in engineering education. As for the highest qualification earned, the majority of participants or 51.8% were recorded to have a Doctoral degree as their highest degree while 36.3% possess a Masters degree while only 11.9% participants possess their Degree qualification alone.

With regards to work experience, Table 7.2 summarises that only 30.8% of participants stated that teaching at the current institute is their first job while 69.2% or the majority of participants has worked in other fields before they become an engineering educator.

Table 7.2: Current Position as Their First Job

	Frequency	Percent
Yes	117	33.1
No	236	66.9

In addition to this, 51.8 % of respondents added that they have worked in an engineering field before they joined the education field as per Table 7.3.

Table 7.3: Work in Engineering Field Before Joining Education

	Frequency	Percent
Yes	183	51.8
No	170	48.2

With regards to participants' experience in their current position as an educator in engineering education, Table 7.4 summarises their working duration at the current institute. 27.5% of participants had worked in the institution for between 5-10 years which represented the highest number of participants while only 2.3% of participants recorded joining after graduation.

Table 7.4: Working Duration at Current Institute

	Frequency	Percent	Cumulative Percent
After graduation	8	2.3	1.9
Less than 2 years	57	16.1	15.8
More than 2 to 5 years	78	22.1	40.0
More than 5 to 10 years	97	27.5	68.5
More than 10 to 20 years	85	24.1	92.7
More than 20 years	28	7.9	100.0

### 7.3 Descriptive Statistic

Regarding the results from the survey, the data was examined by using descriptive statistics on the individual questionnaire items. Descriptive statistics allow the data to be explored for each item in the questionnaire, producing mean, median and modal values as well as standard deviation. These results allowed the researcher to develop an initial understanding of the data collected during the quantitative phase.

All the variables are measured by using the five (5) point Likert scale ranging from 1= Strongly Disagree, 2= Disagree, 3= Neutral, 4 = Agree and 5= Strongly Agree. The results are calculated for the mean where it provides the central tendency for each area studied, while the standard deviations offered an available definition to explain potential variations for each distribution. According to Heir et al. (2006), results from the mean value can be categorised into 3 levels namely: low, moderate and high as shown in Table 7.5 below: -

Table 7.5: Level of Mean Value (Adapted from Hair et al., 2006)

Category Level	Mean range value
Low	1.0 to 2.33
Moderate	2.34 to 3.66
High	3.67 to 5.00

Hence, based on the table above, the mean value, standard deviation and the categorisation level for the overall results used in this study are shown in Table 7.6: -

Table 7.6: Overall Results from Descriptive Analysis of the Variables Table

	<b>Mean</b>	<b>Std. Deviation</b>	<b>Level</b>
a) Staff perception on AL implementation	4.17	0.70	High
b) Motivation to adopt AL approach	3.75	0.88	High
c) Staff understanding on AL implementation	3.79	0.73	High
d) Staff attitude towards AL implementation	4.03	0.66	High
e) Training for AL implementation	3.57	0.96	Moderate
f) Teaching & Planning for AL Implementation	3.67	0.77	High
g) Facilities for AL implementation	3.56	0.90	Moderate
h) Management Support	3.24	0.95	Moderate
i) Colleague support	3.37	0.89	Moderate
j) Challenges	3.67	0.87	High

From Table 7.6, it can be summarised that the mean values are recorded as high for staff perception, motivation to adopt AL, staff understanding, staff attitude, teaching and planning as well as challenges in AL implementation. Moderate levels of mean value can be seen in training, facilities for AL, management support as well as support from colleagues. Details of mean scores for each variable listed in Table 7.6 can be found in Appendix 24.

The following data shows the detailed information on the frequency of responses by participants based on the variable listed: -

a) Staff perception with regards to AL implementation

Table 7.7: Frequency of Observation on Staff Perception with Regard to AL Implementation

	Strongly Disagree		Disagree		Undecided		Agree		Strongly Agree	
	N	%	N	%	N	N	%	N	%	N
1. Adopting AL makes the learning and teaching more interesting for students	2	.6			22	6.2	195	55.2	134	38.0
2. AL encourages students to become independent learners	1	.3	3	.8	33	9.3	194	55.0	122	34.6
3. AL helps students to improve their communication skills	1	.3	1	.3	25	7.1	191	54.1	135	38.2
4. AL helps to improve students' team working abilities	3	.8	2	.6	23	6.5	190	53.8	135	38.2
5. AL helps improve students' critical thinking skills	1	.3	1	.3	28	7.9	189	53.5	134	38.0
6. AL helps improve students' problem-solving abilities	1	.3	2	.6	28	7.9	189	53.5	133	37.7
7. AL is well received by students with a good academic background	3	.8	14	4.0	105	29.7	159	45.0	72	20.4
8. AL is more appropriate in a practically oriented subject	4	1.1	23	6.5	69	19.5	171	48.4	86	24.4
9. AL helps to promote student learning	1	.3	1	.3	41	11.6	192	54.4	118	33.4

b) Motivation to adopt AL approach

Table 7.8: Frequency of observation on Motivation to Adopt AL Approach

	Strongly Disagree		Disagree		Undecided		Agree		Strongly Agree	
	N	%	N	%	N	N	%	N	%	N
1. Adopting AL is a current trend, so I use it to stay up to date	13	3.7	21	5.9	91	25.8	170	48.2	58	16.4
2. Awarding organisations such as MQA and the Board of Engineers encourage higher education institution to adopt AL	5	1.4	9	2.5	83	23.5	192	54.5	64	18.1
3. To fulfil the institution's requirement	10	2.8	13	3.7	77	21.8	188	53.3	65	18.4
4. The implementation of AL is stated as part of my job description	14	4.0	40	11.3	106	30.0	146	41.4	47	13.3
5. Incentives adopted by my institution encourage educators to adopt AL	28	7.9	50	14.2	109	30.9	113	32.0	53	15.0
6. It is my initiative to employ an AL approach	5	1.4	10	2.8	87	24.6	179	50.7	72	20.4
7. As an educator, AL gives me better self-satisfaction as compared to a traditional approach	1	.3	4	1.1	78	22.1	186	52.7	84	23.8
8. I prefer AL compared to the traditional approach because it provides me with new teaching experiences	2	.6	6	1.7	83	23.5	171	48.4	91	25.8

c) Staff understanding on AL implementation

Table 7.9: Frequency of observation on Staff Understanding on AL Implementation

	Strongly Disagree		Disagree		Undecided		Agree		Strongly Agree	
	N	%	N	%	N	N	%	N	%	N
1. I know the concept behind the chosen AL approach	2	.6	20	5.7	113	32	181	51.3	37	10.5
2. I know that AL employs a student-centred approach			10	3.8	69	19.5	203	57.5	71	20.1
3. I know the type of activities involved in an AL implementation	2	.6	17	4.8	104	29.5	196	55.5	34	9.6
4. I am aware on the advantages and disadvantages of AL	1	.3	9	2.5	85	24.1	211	59.8	47	13.3
5. I am aware on the challenges faced in AL	0	.6	9	2.5	77	21.8	202	57.2	63	17.8
6. I am aware of the role of the lecturer in AL	2	.6	9	2.5	76	21.5	206	58.4	60	17.0
7. I am aware on the role of students in AL	1	.3	9	2.5	70	19.8	227	64.3	46	13.0
8. I know how to organize the curriculum for an AL approach	4	1.1	23	6.5	131	37.1	159	45.0	36	10.2
9. I am aware of the rationale for implementing AL in my courses	1	.3	16	4.5	81	22.9	207	58.6	48	13.6

d) Staff attitude towards AL implementation

Table 7.10: Frequency of observation on Staff Attitude on AL Implementation

	Strongly Disagree		Disagree		Undecided		Agree		Strongly Agree	
	N	%	N	%	N	N	%	N	%	N
1. I am willing to change my previous practice to fulfil AL requirements	3	.8	8	2.3	62	17.6	217	61.5	63	17.8
2. I am willing to share my knowledge with my colleagues	1	.3			43	12.2	224	63.5	85	24.1
3. I need to be proactive in preparing AL activity	1	.3	1	.3	43	12.2	228	64.6	80	22.7
4. I need to have self-initiative in preparing AL activity			5	1.4	44	12.5	223	63.2	81	22.9
5. I am always motivated in conducting AL	1	.4	14	4	80	22.7	201	56.9	57	16.1
6. I am keen to facilitate students during AL activities	1	.3	4	1.1	51	14.4	223	63.2	74	21.0
7. I should be able to encourage students to participate in AL activities	1	.3	3	.8	52	14.7	230	65.2	67	19.0
8. I should make myself available for the students to seek for advice	1	.4	2	.6	41	11.6	233	66.0	76	21.5
9. I am always considering the continuous improvement of my AL approach	2	.6			58	16.4	222	52.9	71	20.1
10. I like to explore new approaches to AL	2	.6	4	1.1	62	17.6	196	55.5	89	25.2

e) Training for AL Implementation

Table 7.11: Frequency of observation on Training for AL Implementation

	Strongly Disagree		Disagree		Undecided		Agree		Strongly Agree	
	N	%	N	%	N	%	N	%	N	%
1. I have attended training on AL awareness	24	6.8	47	13.3	72	20.4	160	45.3	50	14.2
2. I have attended training about conducting AL	19	5.4	47	13.3	79	22.4	154	43.6	54	15.3
3. I have attended training in student facilitation	21	5.9	48	13.6	105	29.7	145	41.1	34	9.6
4. I have enough training to improve my facilitation skills	21	5.9	67	19	131	37.1	106	30	28	7.9
5. I have attended training on AL assessment	29	8.2	57	16.1	117	33.1	113	32.0	37	10.5
6. I have attended training in formulating learning issues	22	6.2	58	16.4	119	33.7	118	33.4	36	10.2
7. I require additional training in the facilitation process	2	.6	18	5.1	69	19.5	179	50.7	85	24.1
8. I require additional training to help me manage the students	1	.3	22	6.2	65	18.4	176	49.9	89	25.2
9. I require additional training in designing the assessment	1	.3	23	6.5	65	18.4	169	47.9	95	26.9
10. I require additional training in formulating learning material	1	.3	18	5.1	72	20.4	175	49.6	87	24.6
11. I have been provided with useful learning material during training	18	5.1	36	10.2	110	31.2	140	39.7	49	13.9

12. Training on AL is mandatory for all academic staff	17	4.8	28	7.9	103	29.2	127	36.0	78	22.1
13. I am given clear guidance from the institution with regards to what kind of training that I should fulfil.	14	4.0	51	14.4	119	33.7	131	37.1	38	10.8
14. I was given appropriate time to attend training prior to implementation	21	5.9	48	13.6	139	39.4	116	32.9	29	8.2
15. I have received adequate trainings prior to AL implementation	2	6.2	58	16.4	130	36.8	116	32.9	27	7.6
16. Continuous training on AL is important	2	.6	9	2.5	66	18.7	176	49.9	100	28.3
17. Staff should be assessed after attending AL training	8	2.3	21	5.9	84	23.8	177	50.1	63	17.8
18. Only staff who have been successfully assessed should implement AL	18	5.1	37	10.5	116	32.9	131	37.1	51	14.4
19. There should be ongoing observation from experts with regards to AL implementation	5	1.4	16	4.5	87	24.6	184	52.1	61	17.3
20. I need more focused training with regards to AL implementation	5	1.4	12	3.4	101	28.6	175	49.6	6.	17.0

f) Teaching & Planning for AL Implementation

Table 7.12: Frequency of observation on Teaching & Planning for AL implementation

	Strongly Disagree		Disagree		Undecided		Agree		Strongly Agree	
	N	%	N	%	N	%	N	%	N	%
1. I emphasise the intended learning outcome to the students before class commences	3	.8	6	1.7	63	17.8	217	61.5	64	18.1
2. I make the assessment requirements clear to the students at the start of the AL activity	3	.8	7	2.0	72	20.4	216	61.2	55	15.6
3. I have adequate teaching material with regards to AL implementation	6	1.7	24	6.8	116	32.9	171	48.4	36	10.2
4. Teaching materials are up to date with regards to AL implementation	6	1.7	22	6.2	110	31.2	180	51.0	35	9.9
5. I have identified appropriate activities in order to develop the intended skills during AL implementation	2	.6	20	5.7	96	27.2	200	56.7	35	9.9
6. I have provided enough activity for students to develop their skills during AL implementation	2	.6	26	7.4	131	37.1	165	46.7	29	8.2
7. I have offered enough time for students to develop the intended skills during AL activity	3	.8	22	6.2	123	34.8	174	49.3	31	8.8
8. I have several methods of assessment to assess my students	3	.8	25	7.1	99	28.0	188	53.3	38	10.8

9. The assessments used are aligned with the AL approach	3	.8	19	5.4	109	30.9	182	51.6	40	11.3
10. I know how to observe the students' activities	3	.8	17	4.8	95	26.9	199	56.4	39	11.0
11. I know how to facilitate the students' learning	1	.3	20	5.7	85	24.1	208	58.9	39	11.0
12. I know how to evaluate the students' performance	1	.3	20	5.7	92	26.1	199	56.4	41	11.6
13. I know how to deal with passive students	3	.8	41	11.6	117	33.1	173	49.0	19	5.4
14. I know how to formulate learning issues	2	.6	29	8.2	115	32.6	186	52.7	21	5.9
15. I know how important the reflection session is for students in the AL process	1	.3	17	4.8	92	26.1	195	55.2	48	13.6
16. I know how to align the AL approach with the curriculum	1	.3	33	9.3	107	30.3	176	49.9	36	10.2
17. Curriculum review is done periodically	5	1.4	16	4.5	116	32.9	173	49.0	43	12.2

g) Facilities for AL implementation

Table 7.13: Frequency of Observation on Facilities for AL Implementation

	Strongly Disagree		Disagree		Undecided		Agree		Strongly Agree	
	N	%	N	%	N	%	N	%	N	%
1. Appropriate learning spaces are in place for AL implementation (eg:- classroom, discussion room, laboratory, library etc)	7	2.0	41	11.6	94	26.6	166	47.0	45	12.7

2. Appropriate learning layouts are in accordance with the AL requirement	3	.8	50	14.2	123	34.8	143	40.5	34	9.6
3. Learning equipment (eg:, white board, LCD projector, etc ) are sufficient for AL implementation	5	1.4	32	9.1	100	28.3	169	47.9	47	13.3
4. Learning equipment are in place for AL implementation	4	1.1	35	9.9	101	28.6	173	49.0	40	11.3
5. Technology devices such as laptops and computers are available within the institution for students to use	4	1.1	38	10.8	85	24.1	176	49.9	50	14.2
6. Internet connection within the institution is sufficient for AL implementation	15	4.2	41	11.6	82	23.2	159	45.0	56	15.9
7. Learning resources (eg: journal database, books, etc) are sufficient for AL implementation	6	1.7	41	11.6	100	28.3	166	47.0	40	11.3
8. Learning resources are up to date for AL implementation	2	.6	41	11.6	122	34.6	149	42.2	39	11.0
9. The accessibility of learning resources such as research database via the internet is sufficient	7	2.0	39	11.0	101	28.6	165	46.7	41	11.6

h) Management Support

Table 7.14: Frequency of Observation on Management Support for AL Implementation

	Strongly Disagree		Disagree		Undecided		Agree		Strongly Agree	
	N	%	N	%	N	%	N	%	N	%
1. All staff have clear direction on the institution's goals with regard to AL implementation	14	4.0	49	13.9	134	38.0	133	37.7	23	6.5
2. Management provide clear guidance in AL implementation. (eg;- policy for the staff and students)	14	4.0	56	15.9	138	39.1	123	34.8	22	6.2
3. Management has given sufficient financial support with regards to AL implementation	20	5.7	70	19.8	141	39.9	105	29.7	17	4.8
4. Management has provided enough facilities with regards to AL implementation	9	2.5	53	15.0	141	39.9	125	35.4	25	7.1
5. Management has provided enough training with regards to AL implementation	13	3.7	59	16.7	150	42.5	112	31.7	19	5.4
6. Management motivates staff in AL implementation by providing incentives	24	6.8	71	20.1	119	33.7	115	32.6	24	6.8
7. Management respond to every feedback received from the staff with regards to AL implementation	19	5.4	56	15.9	156	44.2	97	27.5	25	7.1

8. Management has put AL as a priority for teaching	14	4.0	41	11.6	140	39.7	136	38.5	22	6.2
9. Management has assign someone to lead the AL implementation within the institution	12	3.4	25	7.1	127	36.0	157	44.5	32	9.1
10. The leader regularly updates the staff on the AL implementation	17	4.8	50	14.2	140	39.7	121	34.3	25	7.1
11. I work closely with the leader in order to achieve a successful AL implementation	19	5.4	61	17.3	138	39.1	110	31.2	25	7.1
12. The leader always responds constructively on issues pertaining to AL implementation	17	4.8	37	10.5	155	43.9	119	33.7	25	7.1
13. There is a proper platform to discuss AL implementation within the institution	17	4.8	53	15.0	135	38.2	117	33.1	31	8.8
14. I am satisfied the way information is conveyed within the institute with regards to AL implementation	17	4.8	52	14.7	143	40.5	116	32.9	25	7.1
15. Communication between relevant key stakeholders is effective with regards to AL implementation	13	3.7	51	14.4	140	39.7	115	32.6	34	9.6

i) Support from Colleagues

Table 7.15: Frequency of Observation on Colleague Support for AL Implementation

	Strongly Disagree		Disagree		Undecided		Agree		Strongly Agree	
	N	%	N	%	N	%	N	%	N	%
1. My colleagues and I always discuss AL implementation	12	3.4	62	17.6	126	35.7	134	38.0	19	5.4
2. My colleagues and I work together to achieve a successful AL implementation	12	3.4	48	13.6	123	34.8	153	43.3	17	4.8
3. My colleagues and I always encourage each other to adopt AL in class	11	3.1	47	13.3	122	34.6	150	42.5	23	6.5
4. My colleagues and I are positive about AL implementation	9	2.5	26	7.4	117	33.1	178	50.4	223	6.5
5. My colleagues and I always share issues with regards to AL implementation	11	3.1	36	10.2	119	33.7	167	47.3	20	5.7
6. My colleagues and I frequently exchange knowledge about AL implementation	12	3.4	41	11.6	131	37.1	145	41.1	24	6.88
7. My colleagues and I always critique each other to promote improvement	15	4.2	57	16.1	140	39.7	125	35.4	16	4.5
8. My colleagues and I work together to improve our AL implementation	13	3.7	44	12.5	126	35.7	149	42.2	21	5.9

9. My colleagues and I constantly update each other on the status of the AL implementation	15	4.2	77	13.3	123	34.8	142	40.2	26	7.4
10. I have no problem working with my colleagues on an AL implementation	9	2.5	17	4.8	110	31.2	179	50.7	38	10.8

j) Challenges Faced on AL implementation

Table 7.16: Frequency of Observation on Challenges Face in AL Implementation

	Strongly Disagree		Disagree		Undecided		Agree		Strongly Agree	
	N	%	N	%	N	%	N	%	N	%
1. Time limitation is the most significant obstacle facing a successful AL implementation	1	.3	13	3.7	77	21.8	172	52.3	72	27.7
2. It is difficult to cover the entire syllabus using AL approach	2	.6	23	6.5	97	27.5	145	41.1	86	24.4
3. It is important to have a sufficient class duration with regards to AL implementation	1	.3	3	.8	74	21.0	196	55.5	79	22.4
4. Previous educational culture hinders the AL implementation amongst students	5	1.4	15	4.2	109	30.9	167	47.3	57	16.1
5. Teaching large groups of students prevents an AL approach	6	1.7	27	7.6	89	25.2	154	43.6	77	21.8

6. Students are afraid to participate in AL implementation due to their 'feelings of respect' for the teacher	16	4.5	50	14.2	118	33.4	131	37.1	38	10.8
7. It is hard to employ the AL approach with low achieving students	11	3.1	45	12.7	126	35.7	132	37.4	39	11.0
8. Some staff hinder the AL approach as they don't want to lose control in class	7	2.0	30	8.5	129	36.5	155	43.9	32	9.1
9. Some staff feel that students still prefer a teacher-centered approach	3	.8	15	4.2	107	30.3	180	51.0	48	13.6
10. Some parents complain about the AL approach due to a misunderstanding believing there is 'no teaching in the class'	19	5.4	49	13.9	134	38.0	117	33.1	34	9.6
11. No clear policy provided on AL implementation	8	2.3	22	6.2	118	33.4	154	43.6	51	14.4
12. Lack of understanding of AL implementation	5	1.4	23	6.5	109	30.9	163	46.2	53	15.0
13. Lack of staff motivation	4	1.1	25	7.1	9.6	27.2	165	46.7	63	17.8
14. Lack of monitoring hinders successful AL implementation	7	2.0	23	6.5	104	29.5	156	44.2	63	17.8
15. No reflection is performed to examine the effectiveness of AL implementation	4	1.1	29	8.2	113	32.0	166	47.0	41	11.6
16. It takes time to adopt a new approach to teaching			9	2.5	82	23.2	193	54.7	69	19.5
17. Financial constraints faced by the institution	5	1.4	20	5.7	110	31.2	156	44.2	62	17.6

## 7.4 Reliability Analysis

This section provides the analysis and findings for the reliability tests conducted on the actual sample size of 353 participants within this study. According to Sekaran and Bougie (2011), the reliability test is done in order to ensure the internal consistency of the measurements of the item used. Based on Hair et al., (2010), the rule of thumb for the acceptance level of Cronbach's alpha value must be higher than 0.70. Thus, the cut-off point for the reliability test for this study is set at a coefficient alpha value above 0.70. Table 7.17 displays the Cronbach's coefficient alpha value of the variables collected from 353 participants.

Table 7.17: Reliability Coefficient for Variable

	Cronbach's Alpha
a) Staff perception on AL implementation	0.861
b) Motivation to adopt AL approach	0.805
c) Staff understanding on AL implementation	0.918
d) Staff attitude towards AL implementation	0.923
e) Training for AL implementation	0.907
f) Teaching & Planning for AL Implementation	0.944
g) Facilities for AL implementation	0.928
h) Management Support	0.968
i) Colleague support	0.963
j) Challenges	0.907

Based on Table 7.17 above, the Cronbach's alpha values for all of the study variables are above 0.70 ranging from a minimum of 0.805 to 0.968 which demonstrates the acceptable level of 0.70 as stated by Hair et al., (2010). Overall, the analysis indicates that each instrument was meaningfully measured and represented by acceptable reliability levels.

## 7.5 Assumptions Regarding Multiple Regressions

Prior to using multiple regression analysis to explore the relationships among the variables namely the dependent variables and the independent variables, Tabachnick and Fidell (2007) recommend the following assumptions 1) normality, 2) linearity, 3)

homoscedasticity of residuals and 4) multi-collinearity and singularity be fulfilled. Hence, the analysis is presented in this section.

### 7.5.1 Normality Test

The normality of data distribution was examined by the skewness and kurtosis values for each variable. Skewness values present the symmetry of the distribution score and a skew variable's mean will not be at the center of this distribution. Kurtosis presents information regarding the "peakness" of the distribution and it can be either too peaked (with a short and thick tail) or too flat (with a long and thin tail) (Tabachnick & Fidell, 2007). Normal distribution is considered when the value of skewness and kurtosis is at zero (0). A positive skewness value will have a cluster of cases to the left at a low value and a negative skewness will have the score cluster or pile at the right side with a long left tail (Tabachnick & Fidell, 2007). Table 7.18 is a summary of the skewness and kurtosis for all the variables. The data shows the variables were normally distributed. Therefore, in conclusion, all the variables do not deviate from the normality test requirement.

Table 7.18: Skewness and Kurtosis for the Variables

	Skewness Stats	Std Error	Kurtosis Stats	Std Error
Preparedness	-.563	.130	1.286	.259
Training	-.115	.130	-.296	.259
Management Support	-.304	.130	.131	.259
Institution Culture	-.355	.130	.111	.259

### 7.5.2 Linearity Test

Another assumption to comply with is the linearity of the data where it shows the relationship between the residuals against the predicted values. Linearity refers to the error term of the distribution. Linearity is important for the regression analysis because correlation can capture only the linear association between variables and if there are substantial non-linear relationships, it will be ignored in the analysis because it will underestimate the actual strength of the relationship (Tabachnick & Fidell, 2007). According to Hair et al. (2006) linearity can be observed by examining the scatterplot diagrams when various variables indicate no clear relationship between the residuals and the predicted values.

Figure 7.1 shows assessment of all scatterplots of the standardized residual versus standardized predicted values and revealed that in all the plots the residuals were scattered with no systematic or curvilinear pattern (U shape distribution) or clustering of residuals as indicated by Tabachnick and Fidell (2007). The randomized pattern of the scatter plots indicated that the assumption of linearity was met. Therefore, the linearity could be assumed.

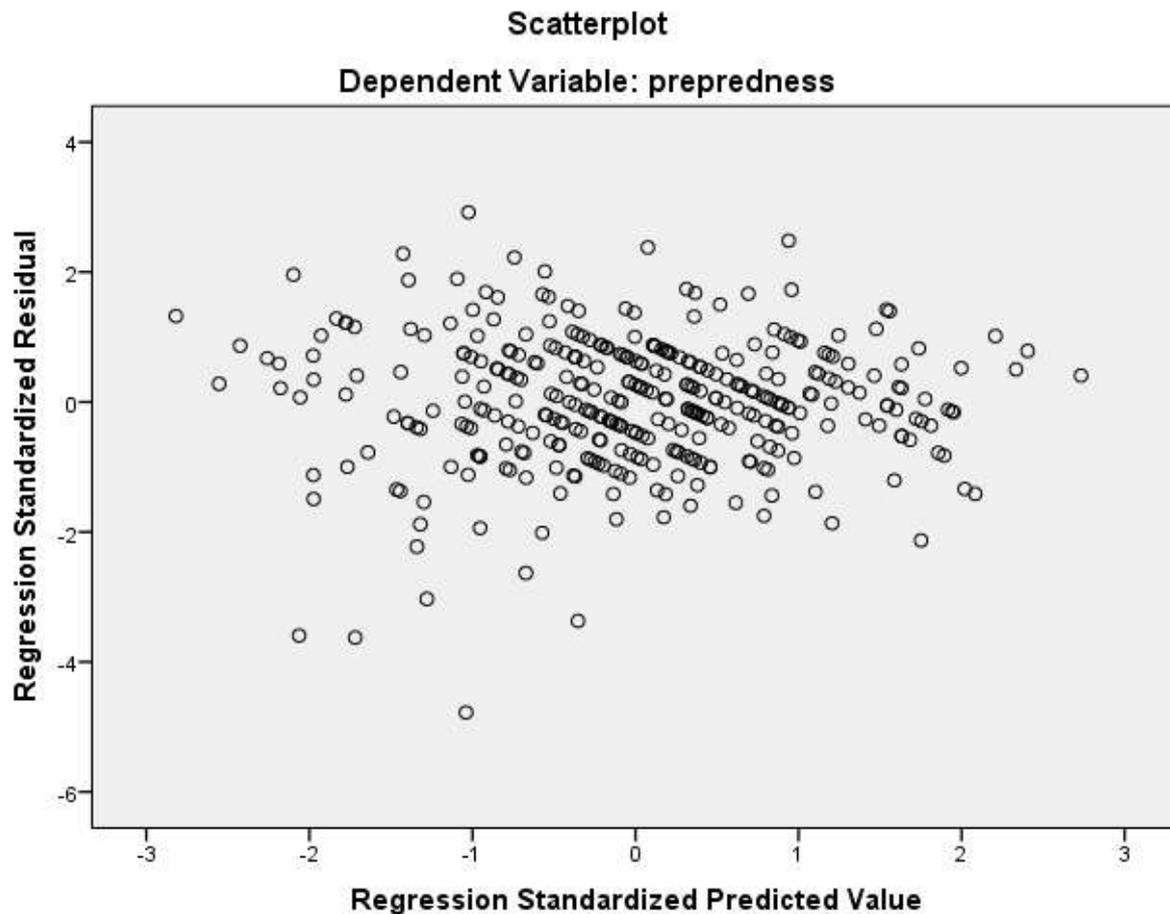


Figure 7.1: Scatterplots Of Standardized Residuals Against The Predicted Values Of Linearity Test

### 7.5.3 Homoscedasticity Test

Homoscedasticity refers to assumption that the variance around the regression line remaining the same for all predictor (independent) variables (Tabachnick & Fidell, 2007). The assumption requires the degree of random noise in the dependent variable to be remain the same regardless of the values of the independent variable (Kahane, 2007). Violation of this assumption is called “heteroscedasticity” (Hair, 2010). Homoscedasticity could be checked by visual from scatter plot, which plot of standardized residual against the regression predicted values were used (Osborne & Waters, 2002). Hair et al. (2006) assert that it is a necessary to

inspect the plots so that the residuals were scattered randomly with no obvious systematic pattern. Figure 7.2 below shown that the residual distributed around the mean (mean of residual equal 0) and there is no systematic pattern. Thus, it can be assumed that the assumption of homoscedasticity is not violated.

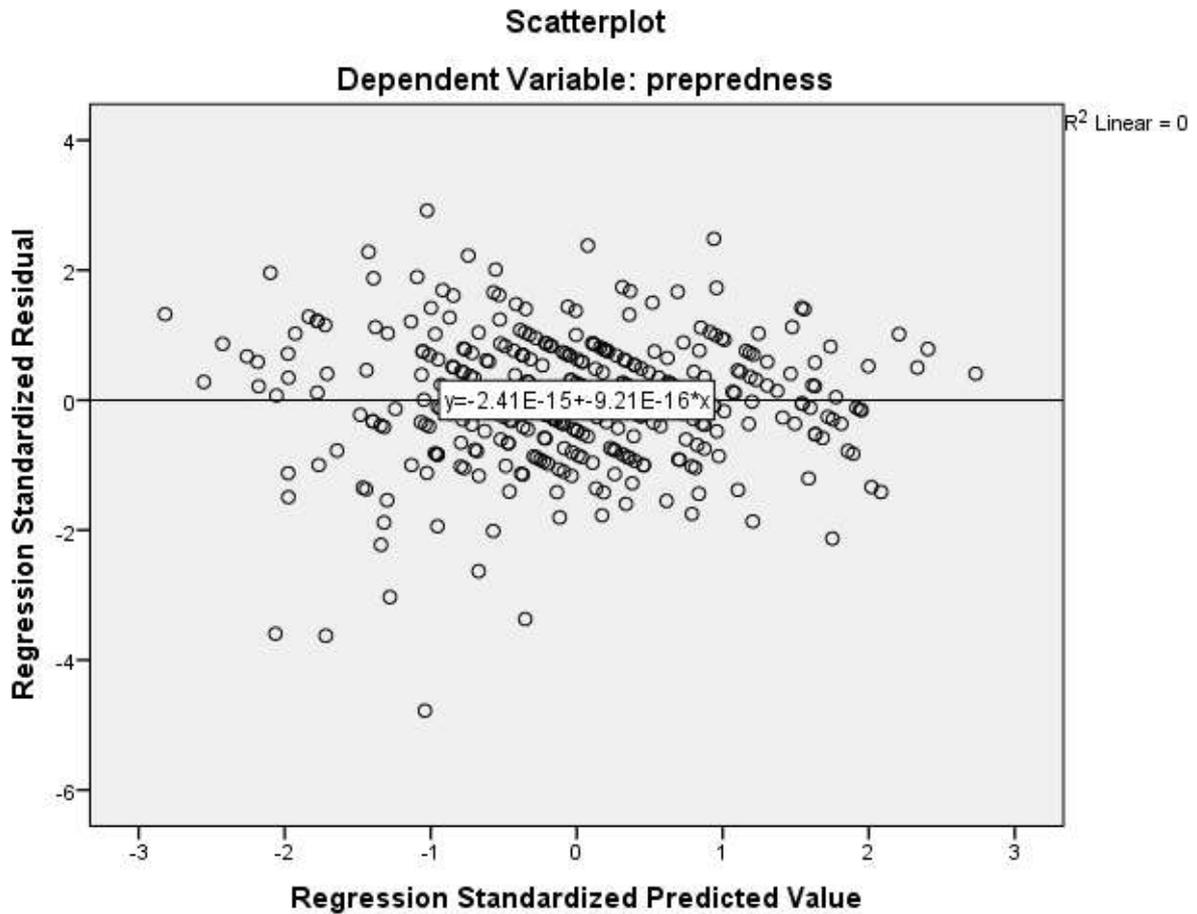


Figure 7.2: Scatterplots of Standardized Residuals Against the Predicted Values of Homoscedasticity Test.

#### 7.5.4 Multi-Collinearity Test

The assumption of multi-collinearity was tested using the Variance Inflation Factor (VIF). Tabachnick and Fidell (2007) indicate that the VIF value should be less than 10 and the tolerance value more than 0.1. Hence, Table 7.19 indicate that there is no violation of the assumption for this study.

Table 7.19: Multi-Collinearity Test

	Tolerance	VIF
Training	.696	1.438
Management Support	.451	2.216
Institution Culture	.413	2.420

## 7.6 Correlation Analysis

For this study, correlation analysis was conducted in order to associate staff preparedness with regards to the training, management-support and the institutional culture as stated in the research objective. Thus, the use of correlation coefficients is to illustrate the relationship between the independent and dependent variables. For this study, the staff preparedness is identified as the dependent variable and training, management support and institutional culture are the independent variables. For this analysis, the 'Preparedness' is measure by adopting questions that outline preparedness characteristics as defined by Fernandez (2017). 'Facilities' and 'Colleague Support' represent independent variables for Institutional culture, as derived from factors that associates with institutional culture in qualitative findings of this study.

According to Hair et al., (2006), the number representing the Pearson correlation is referred to as a correlation coefficient where it ranges from – 1.00 to + 1.00, with zero representing absolutely no association between the two metric variables. The larger the correlation coefficient the stronger the linkage or level of association. A strong correlation is represented by a coefficient exceeding the value of 0.5 whereas a medium or modest correlation is when the coefficient has a value of between 0.5 and 0.2. Any coefficient possessing a value less than 0.2 will be deemed as showing a weak correlation.

From Table 7.20, it is found that Preparedness is significantly associated with Training (B=0.525,  $p < 0.01$ ). Management Support significantly affects Preparedness (B=0.136,  $p < 0.01$ ) as Institution Culture (B=0.190,  $p < 0.01$ ).

Table 7.20: Correlation analysis on Preparedness with regards to Training, Management Support and Institution Culture

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.642	.143		4.487	.000
	Training	.525	.043	.512	12.223	.000
	Management Support	.136	.039	.179	3.453	.001
	Institution Culture	.190	.054	.192	3.537	.000

## 7.7 Regression Analysis

Table 7.21: Effect of Training, Management Support and Institution Culture on Preparedness

	<i>B</i>	<i>T</i>	<i>Sig</i>
Training	.525	12.223	.000**
Management Support	.136	3.453	.001**
Institutional culture	.190	3.537	.000**
- Facilities	-.033	-2.153	.032
- Colleague Support	-.024	-1.385	.167
R2	.575		
F	157.213		
Sig	.000 <sup>b</sup>		

Notes: \*\* $p < 0.01$ ; \* $p < 0.05$

The result of the regression analysis shown in Table 7.21, found that all the independent variables (Training Management Support Institution Culture) are significantly predictors of Preparedness ( $R^2=0.575$ ,  $F=157.213$ ,  $p < 0.01$ ). However, Table 7.19 shows that Facilities and Colleague Support were not significant to preparedness ( $B=-0.33$ ,  $T=-2.153$ ,  $p=0.32$ ) and colleague support ( $B=-0.24$ ,  $T=-1.385$ ,  $p=0.167$ )

## 7.8 Summary of quantitative findings

The quantitative data presents the overall findings on the staff's preparedness with regards to AL implementation within Malaysian engineering education. The findings start with the demographic data of participants. This study shows the distribution of participants' profiles

in terms of age, gender, education level as well as their working experience. From the 353 participant responses to the questionnaires which represents the engineering educators in Malaysia, the majority of them were aged between 31 to 35 years old comprising of 28% of total samples. 186 out of 353 respondents were male comprising of 52.7%. In terms of education level, respondents that possess a PhD have higher percentage of 51.8% (183) as compared to the respondents that possess a Masters degree comprising of only 36.3% (128).

Descriptive analysis is done to describe the characteristics of the data in terms of mean value, standard deviation and level of value within the five (5) internal scales used ranging from 1=Strongly Disagree, 2= Disagree, 3= Neutral, 4 = Agree and 5= Strongly Agree. The results of the descriptive analysis show that the 'staff attitude towards AL implementation' which is also identified as one of the independent variables scores the highest mean value (mean=3.79, sd=0.88, level= high) while 'management support' shows the lowest mean value (mean=3.24, sd=0.89, level= moderate). For this descriptive analysis, the higher mean value reflects most agreement with the statement presented.

The results of reliability analysis revealed that coefficient alphas for all study variables were above the acceptable level of 0.7 which are ranging from the minimum of 0.805 to a maximum of 0.963. Overall, the analysis indicated that each instrument was meaningfully measured and represented by reliable items. Correlation analysis is conducted to examine the relationship between independent variables, i.e. Training, Management Support and Institution Culture. The results of correlation analysis revealed that overall preparedness is significantly associated with Training, Management Support and Institution Culture used in this study. As for regression analysis with regards to staff preparedness, all the independent variables (Training, Management Support and Institution Culture) are significantly predicted to Preparedness. However, results highlight that Facilities and Colleague Support shows a result of not being significant towards preparedness.

## CHAPTER 8 : META – ANALYSIS AND TRIANGULATION

### 8.1 Introduction

This chapter provides a meta-analysis obtained from both the qualitative and quantitative work done; where the exploratory sequential approach was used to investigate staff preparedness in AL implementation in Malaysian higher education. On top of that, the findings revealed are linked with relevant literature for triangulation purpose. Here, the research question is used to guide the analysis where the results from the second phase of quantitative data are combined with the first phase of qualitative findings. Hence, the exploration of the results will indirectly triangulate the findings on the research work done.

### 8.2 Research Question

For this research, the main research question that underpins this study is *“How prepared are higher education staff to adopt an Active Learning (AL) approach in engineering education?”* Aiming to address the research gap by understanding the actual scenario, the analysis is conducted by answering additional sub-research questions as presented in the following sub-section in order to answer the main research question. The findings from both qualitative and quantitative study are then corroborated with some literature for triangulation purposes on the issues discussed. In addition to this, these sub-questions deliberately assist to frame the key findings for the framework, as the output of this research study.

#### 8.2.1 S-RQ 1: What are the staff perceptions of Active Learning used as an approach in engineering education?

In answering this sub-research question with regards to the staff perception in AL implementation, this perception about AL is closely related to the teaching and learning experience and how well the implementation is adopted or being practised. As both case studies are pioneers in implementing AL within their specific sector, staff feedback is vital as it represents their experience in dealing with this new approach in a context in which the education system in Malaysia mainly depends on teacher-oriented classrooms.

Results from the qualitative phase show that there was a rejection during the early implementation of AL approach. In both case studies, participants were sceptical with the new approach introduced to them. However, the negative perception changes as the staff started

to see the results of how the AL benefits the students. From the qualitative findings, the responses from the staff agreed that AL implementation has changed students' way of learning as mentioned by one participant during their interview: -

*“The main advantage that I realise is the students are more pro-active. They are active in class and they are not just listening. Another advantage that I also can see is the students are having better communication”.*

CS1-S1

The results from the quantitative survey also confirm that participants possess a positive perception on AL implementation (Mean =4.18). From the survey, the majority of participants agree that AL implementation encourages students to become independent learners (Mean = 4.21), AL helps students to improve their communication skills (Mean = 4.32), AL helps improve students' critical thinking skills (Mean = 4.32), AL helps to improve students' team working abilities (Mean = 4.29) and AL helps to promote student learning (Mean = 4.23).

Referring to the findings, the results agree that AL implementation has encouraged students to become more pro-active in the classroom and be an independent learner as compared to the traditional approach. In addition, the majority of participants agree that AL improves the students' communication skills, critical thinking skills and team working abilities. Thus, findings are aligned with previous studies and literature, and show that the implementation of AL has been accepted due to its advantages within higher education, particularly in engineering education (Radzali et al., 2013; Borhan, 2012; Yusof et al., 2004).

#### 8.2.2 S-RQ2 - What are the factors that influence staff preparedness in AL implementation?

From the qualitative findings, a total of nine final themes were derived that relate to the factors that influence staff preparedness in AL implementation. The themes are understanding; staff attitude; training; facilities; support; leadership; planning; communication and learning culture. Hence, in answering the sub-research question, the explanation will be based on a list of themes that emerged from the findings.

##### 8.2.2.1 Theme 1: Understanding

Analysis from the qualitative study indicate that most of the staff are confused over the definition of AL used (either PBL or WBL). As the researcher discovered that understanding is a basic element that most staff should possess before implementing the AL approach, the

majority of the participants involved in qualitative study possess a different understanding which is based on their own interpretation. Hence, the implementation of the AL will be based on their understanding as highlighted by one of the participant below: -

*“We just base it on our own understanding, what we know and what we think is the best”.*

CS1-S3

In other words, for a proper AL adoption, the researcher agrees that the ability of the staff to possess a ‘good understanding’ of the AL used indirectly will influence how they react, which ultimately leads to either an acceptance or rejection of this approach. In support of that, the findings from the quantitative survey also agree that staff understanding has a significant effect on AL implementation (Mean=3.80). For instance, the findings from the face-to-face interviews reflected that those staff who are having problems gaining a clear understanding of the intended innovation tend to give excuses about the implementation. This is due to the fact that, the staff are unable to understand what is expected from the adopted AL used resulting in different interpretations in understanding and implementation. Hence, the findings from the quantitative data agree that it is important for staff to understand the concept behind the chosen AL before implementing it (51% agree on the statement). Apart from this, the staff also should know the type of activities involved in AL implementation (65.1% agree) as well as knowing their role in the AL environment (75.4%). In addition to this, 55.2% of participants agree that the staff should know how to organize the curriculum with regards to AL implementation. Hence, the ability of the staff to understand the AL requirements will help them to be prepared in an AL environment where the staff need to respond to the changes as compared to previously teacher-centred approaches. In supporting this finding, a previous study by Chan (2016) as well as Rasul & Yasin (2014) also highlighted that a successful AL implementation greatly depends on the staff understanding of the AL used and the processes involved. This is due to the fact that, if the staff are unable to understand what is expected from the adopted AL, it will consequently result in different interpretations in implementation (Kudryashova et al., 2016).

#### 8.2.2.2 Theme 2: Staff attitude

With regards to staff attitude, both findings from two case studies in the qualitative phase highlight that the staff should possess a positive attitude in implementing the AL approach. This is due to the fact that AL adoption requires additional tasks from the staff where they need to prepare additional learning materials as compared to a traditional one-way teaching

approach. For instance, findings from the interview reveal that staff who possess a positive attitude to work (e.g. hardworking) react differently towards AL implementation where they are being pro-active in preparing themselves despite having to wait for the training to be given to them. This can be seen when the staff was taking the initiative to prepare proper learning materials that help for AL activity. Unlike the staff who possess negative attitude, findings from interview revealed that there was a case where PBL activity was done by just 'giving an assignment to the students to complete'. This situation occurs due to the fact that the AL implementation is done just to comply with instructions given by the management to do PBL in their class.

With regards to staff attitude, the above findings also align with quantitative study where data shows a high mean on the issue discussed (Mean = 4.03). Hence, the majority of participants agree that staff attitude does have a significant effect on staff preparedness in AL implementation where 87.3% of participants in the survey agree that the staff need to be proactive in preparing AL activity. In relation to this, as AL implementation requires them to change their perspective of traditional educator controlling the class, 79.3% of participants agreed that they are willing to change their previous practice to fulfil the AL requirements. Therefore, findings from both qualitative and quantitative work done parallel with research conducted by Jamaludin and Sahibuddin (2012), who similarly agree that human factors or attitudes play a significant role in successful AL implementation.

### 8.2.3 S-RQ3: What mechanisms are in place to support staff who are introducing AL?

#### 8.2.3.1 Theme 3: Training

Much literature as well as studies has indicated the need for training and the importance of it with regards to AL implementation (Chan, 2016; Rasul & Yasin, 2014; Radzali et al., 2013; Nopiah, et al., 2008;). In fact, it is one of the main criteria that should be taken care of in order to prepare the staff for AL implementation. Analysis from quantitative work also highlights that staff preparedness is significantly associated with training. However, the evidence from one of the participants in the qualitative findings in both case studies revealed that the training for the staff was insufficient.

*"I think we need more training on teaching skills, communication skills as well as technical skills.*

CS2-S15

The issue of insufficient training aligned with quantitative findings where data indicate a moderate value (mean=3.57) on the issue discussed.

For instance, in introducing the AL approach to the staff, awareness training is important in order for them to understand the purpose of AL adoption. However, the findings from both case studies reveal that there was a lack of information given to the staff with regards to the AL used. This finding also similar as highlighted by Radzali e al. (2013) with regards to changing new approach to the staff from traditional ethos. The majority of participants in both case studies highlighted that only selected staff were chosen to undergo training particularly during the initial stage of implementation. This finding is also parallel to the quantitative finding where only 59.5% responded that they had attended training on AL awareness. 20.1% admit that they have never attended any awareness training while 20.4% chose to stay neutral. This situation indirectly reflects their insufficient awareness of the purpose of the AL that they were to employ.

With regards to AL implementation, participants from both case studies also revealed that the majority of the staff involved struggled to adopt appropriate learning and teaching styles to suit the AL requirement. Again, lack of training has caused the staff to fail to understand their role and what is expected from them within an AL environment as highlighted by previous literature with regards to staff training (de Graaff, 2013; Bouhuijs, 2011). This issue is aligned with quantitative findings where only 58.9% agree that they have attended training with regards to conducting AL. 18.7% of participants revealed that they did not attend the training and 22.4% stayed undecided. One of the common issues highlighted by the staff during the learning and teaching process is facilitation. Further findings from both case studies revealed that they were not sure how to properly guide and facilitate the students to achieve the learning outcomes as highlighted by one of the participants during interview:-

*"I think we still need to improve our skills on how to facilitate students."*

CS1-S8

Responses from the students also validate the issue as they had difficulties understanding what the outputs of each learning session are as they were having problems understanding the educators' expectations of them. This finding was found to be parallel with the quantitative data where only half of the respondents (50.7%) agreed that they have attended students' facilitation training and 19.5% did not attend the facilitation training while 29.7% chose not to reveal their position. This quantitative finding has led to the subsequent statement that only 37.9% of participants agreed that they have had enough training to

improve their facilitation skills and 24.9% disagree on the statement while 37.1% to stay undecided. Thus, obviously there is a lack of training in AL facilitation that needs to be focused on, as a majority of the participants did not have a clear picture on how the facilitation should be conducted. This is due to a majority of the staff and educators having graduated from traditional teacher-centred institutions where a one way, transmission style of teaching is the norm. This situation of findings is also similar to literature where the staff find it difficult to change their role from knowledge provider to a facilitator (Lian, 2010; Hannum & McCombs, 2008; Witfelt, 2000).

Another important finding highlighted during the qualitative phase is on the assessment that suits AL adoption. For instance, the findings from Case Study 1 reveal that the majority of the staff do not know how to properly assess the students by using the AL that they employ. However, findings from Case Study 2 reveal that the staff are not aware of how their learning activities can contribute to the effective assessment of the students as most of them do not possess a good understanding of the content or syllabus of the course. Hence, this situation indirectly shows that a lack of training on the assessment hinders the staff in achieving the AL assessment goals. This similar finding can be seen from the quantitative data where only 42.5 % of respondents agree that they have attended training on AL assessment and 24.3% disagree on that statement while 33.1% prefer to keep neutral. Again, this issue is similar as highlighted in previous studies where the staff are facing difficulties in performing assessment where the curriculum and assessment used should reflect the AL approach (Kamsah & Talib, 2014; Shaari & Jusoh, 2012).

Apart from this, findings from qualitative studies highlight the importance of continuous training as highlighted by participants during interview. This statement is agreed by the majority of survey participants in quantitative study where (78.2%) shows the need for continuous training with regards to AL adoption. Furthermore, detailed results from the survey confirm that a majority of participants required additional training with regards to facilitation (74.8%), managing students (75.1%), designing assessment (74.8%) and formulating learning issues (74.2%).

#### 8.2.3.2 Theme 4: Support

With regards to support towards AL implementation, findings from both case studies reveal that it is important for each institution to have proper support in order to fully achieve AL implementation as highlighted by previous studies (Yusof, 2004; Yeo, 2005). In other words, support from management as well as from colleagues are among important factors in

adopting changes within the education system. This is aligned with quantitative analysis where result for Management Support is significant predicted to staff preparedness. However, findings in Case Study 1 revealed that the majority of the participants were unhappy with the support that they received from the management with regards to AL implementation. This is due to the fact that the majority of the staff assert that the AL implementation was mainly a result of their own initiative after receiving instruction from the management. In addition to this, the staff also expressed their concern on AL adoption as they were not being given a clear direction or information on the institution goals as highlighted during the interview:-

*“Maybe the direction is unclear or maybe the information from top to bottom is not there, and the management also didn’t stress the importance of PBL implementation clearly.”*

CS1-S18

Similar findings were revealed from the quantitative data where only 44.2% of participants possess a clear direction on AL adoption within their institute and 17.9% feel unsure while 38% choose to remain neutral.

On the other hand, participants in Case Study 2 responded that they are satisfied with the management support with regards to WBL implementation. Findings from Case Study 2 reveal that the involvement of all levels of staff as well as management from different areas, shows their commitment to the WBL implementation. Thus, the staff will always feel that there will be a support system available for them to discuss any issues that arise. In addition to this, the availability of WBL guidelines does help the staff to properly implement the WBL approach. However, due to a lack of awareness, only certain staff are aware of the availability of the documents. Findings from the quantitative data also showed moderate mean findings (management support, mean=3.21) where only 41% of participants agree that their management provides clear guidance on AL implementation while 19.9% disagree and 39.1% choose not to reveal their position. This finding indirectly informs the researcher that participants might experience insufficient support from their management during AL implementation. Hence, the issue of receiving appropriate support is probably one of the challenges that is commonly faced by staff in implementing AL adoption as highlighted by Chan (2016). Hence, there is no doubt that the majority of the staff in Case Study 1 felt neglected as they feel that they do not receive appropriate support from their management. Thus, the frustration of not having sufficient support caused the PBL implementation to finally revert back to a traditional approach.

#### 8.2.4 S-RQ4: How can organisational leadership influence staff preparedness?

##### 8.2.4.1 Theme 5: Leadership

Findings from this qualitative study reveal that a competent leadership plays an important role in leading the changes required. This is due to their capability to initiate necessary important steps in preparing the staff towards AL implementation. This is aligned with Kolmos and de Graaff (2007) where a change agent is vital in order to lead the change process. From Case Study 1, the absence of a proper leader to lead the implementation indirectly contributed to a situation of not being prepared. With regards to this theme, findings from the quantitative survey also reveal the need of having a leader prior to AL implementation where 53.6% of respondents agree that management has to assign someone to lead the AL implementation within the institution. Only 10.5% show disagreement while 36% are undecided. However, data on leadership shows a moderate mean where the researcher believes that the majority of staff are having negative experiences in dealing with the leader during AL implementation.

In relation to this, the findings from this study also show that a good leader should be able to monitor the AL implementation and supervise its progress. In Case Study 2, it was revealed that the leader had made an initiative to conduct a curriculum review 2 years after the WBL implementation in order to rectify any problems arising as well as to provide necessary improvements to the WBL implementation. This was supported by the quantitative data where 61.2% agree that a curriculum review is done periodically pertaining to AL implementation which also highlights the need to make sure that the AL used aligns with the curriculum and reflects the desired learning outcomes. Contrastingly, in Case Study 1 no official reflection activity was recorded since the initial implementation stage. In this case, the findings revealed the unavailability of suitable persons in charge to deal with the AL implementation. As a result, the AL implementation within the PBL institute was not properly monitored and it is no surprise for the researcher to discover that some of the participants in Case Study 1 admitted during the interview that they were not employing the AL anymore as they believed that no one would take any action if they reverted to their previous teaching methods. Hence, this finding is similar to quantitative survey where 62% of participants agree that a lack of monitoring hinders successful AL implementation. (29.5% choose undecided and only 8.5% disagree on the statement).

#### 8.2.4.2 Theme 6: Planning

One of the important themes that is closely related to leadership, is engaging a proper plan when employing AL within the institute. The findings from Case Study 2 reveal that it took 2 years for the team to conduct the necessary preparation before officially employing the approach, while the findings from Case Study 1 reveal that only 6 months allocation was given to the staff to do the necessary preparation. Due to the very short time of preparing themselves for the change, the AL implementation was not as properly implemented as it should have been. Previous literature indicates that at least 1 year is necessary to do the appropriate preparation required; in particular, such preparation involves training the staff who will lead the AL approach (Coffin, 2013). Similar findings were observed from the quantitative study where only 41% of participants agreed with the statement that they were given appropriate time to attend training prior to implementation. 19.5% showed disagreement to the statement while 39.4% chose to not taking any side. This condition strongly suggests that the time allocation with regards to the necessary training given to the staff, does affect proper AL implementation. Only 40.5% of respondents agreed that they have received adequate training prior to AL implementation while 36.8% prefer not to reveal their position and 22.6% disagree. Consequently, findings from Case Study 1 reveal that PBL implementation at their institution was based on individual initiative.

#### 8.2.4.3 Theme 7: Communication

With regards to this theme, the findings from interviews reveal that having proper communication had a significant effect on preparing the staff for AL implementation. Overall, only 40% of participants expressed that they are satisfied with the way information is conveyed within the institute with regards to AL implementation. In the case of Case Study 2, a proper committee was set up upon WBL implementation which helps them to communicate effectively as the WBL implementation involved several other parties apart from the WBL institution. Hence, by having a proper committee, it indirectly creates a system for how the group disseminates the information and leads the AL implementation successfully. In addition, as most of staff in Case Study 2 were aware of the committee involved, this situation helped them on how they should respond if any problems arise. Unlike the findings in Case Study 1, where a majority of the respondents expressed concern as there was no proper channel available for them to discuss the implementation. A similar scenario seems to be experienced in the quantitative survey as only 42.2% agree that communication between relevant key stakeholders is effective with regards to AL implementation. 18.1% disagree on the statement while nearly 40% (39.7%) of participants stay neutral. In relation to this, data with moderate

findings (mean= 3.26) on the statement 'There is a proper platform to discuss AL implementation within the institution' where only 33.1% choose to agree and 38.2% remain neutral.

#### 8.2.5 S-RQ5: How can the institutional culture influence staff preparedness?

##### 8.2.5.1 Theme 8: Learning Culture

With regards to this theme, the findings from both case studies reveal that AL implementation was initiated in order to improve on the traditional didactic teaching approach. It is important to highlight that most of the staff as well as the students, are from traditional teacher-centred backgrounds where the learning process is greatly dependent on the teacher. Hence, for the staff, the changes from the traditional approach to a new AL requirement cannot be implemented by only giving instructions as to what the management intended to achieve without proper planning and support. Therefore, in preparing the institute for proper AL implementation, one of the important elements that management needs to be aware of is the need to make sure that the surrounding environment should be transformed parallel to the approach.

In relation to this, data from the quantitative survey reveal that only 38.5% of participants agreed that the management has put AL as a priority for teaching. These results indirectly reflect that the AL adoption was not taken seriously in terms of a change in their learning and teaching style. Based on the findings from Case Study 1, the majority of the participants admitted that their current environment does not support the AL adoption as there was much preparation that needed to be completed in order to make sure that the whole institute was working in the same direction as highlighted by Yusof et al. (2015). For instance, the ignorance of some staff who were not using the AL approach as per requirement, created dissatisfaction among other staff which indirectly created a negative environment within the institution. This situation indirectly shows that there is inadequate support among staff with regards to AL implementation.

In relation to this, study by Borrego, Froyd & Hall (2010), added that faculty attitude also has a significant effect on peers in adopting new pedagogies where support from colleagues is vital. Thus, working together within a support group opens a new perspective in the learning environment among the teachers as well. However, based on the quantitative data, the analysis revealed that colleague support is not significant to preparedness in AL implementation. This situation indirectly shows inappropriate support by the colleague with

regards to AL adoption. This situation is similar in Case Study 2, where one of the participants during interview highlighted the importance of having good support among colleagues in implementing AL at their workplace as this will then create a positive impact on the AL implementation:-

*“We need to have a positive environment so that we can influence others especially junior staff to follow us. If we show negative things, of course everything will be negative then.”*

CS2-S8

#### 8.2.5.2 Theme 9: Facilities

With regards to preparing an appropriate culture for AL implementation, findings also show that this theme is also important with regards to AL implementation. This is due to the fact that preparing necessary resources and facilities indirectly creates an appropriate internal culture within the institute which supports the AL implementation. This is agreed by Rahman, Mokhtar and Yasin (2012) research, where they highlighted that the students' approach to learning is closely related to their learning environment.

For instance, findings from the qualitative study revealed that one of the common issues highlighted by the participants is related to inadequate facilities: -

*“The management encourage us to adopt PBL, but they don't prepare the environment for it. The preparedness from management is less in terms of the infrastructure.”*

CS1-S7

This is supported by the quantitative analysis where facilities were not significant towards preparedness in AL implementation. In other words, the analysis shows that the existing facilities do not support AL implementation. This analysis tallies with the survey findings where quantitative data score moderate mean=3.54 on the issue discussed. One of the common items of feedback from the participants highlight on the internet facilities provided within the institute were still at an inadequate level as there were too many restrictions applied to internet usage. This statement is similar to the quantitative findings where only 60.9% of respondents agree that the internet connection within the institution is sufficient for AL implementation (15.8% disagree and 23.2% are undecided). Hence, the importance of having sufficient internet connection should be given a priority as students nowadays prefer to use cyber facilities to find information rather than going to the library. In relation to this, it is

necessary for the institute to provide computer facilities as the findings from interviews reveal that some of the students do not own a computer or laptop due to their financial backgrounds. Results from the quantitative data also reveal that technology devices such as laptops and computers are among the facilities that should be provided to the students where only 64.1% agree that the devices are available within the institute for students to use. In addition, the findings from Case Study 1 also reveal that there was limited space available for proper implementation as the institute was based on a traditional approach to teaching which is mainly based on normal access to and usage of classrooms and lecture halls. As the AL approach requires the students to work in groups, a different setting for the learning space, as well as the class layout should be designed to accommodate the approach. The same result generated from the quantitative findings, where only 50.1% of participants agreed that appropriate learning layouts are in accordance with the AL requirement while 22.2% disagree and 34.8% are undecided. Thus, the provision of improper facilities does effect the ability to properly implement AL as earlier research also shows that the design of a classroom can have an impact (both positive and negative) on students when experiencing learning in active and collaborative environments (Felder,1995).

#### 8.2.6 S-RQ6: What are the challenges faced by staff in implementing Active Learning?

Findings from Case Studies 1 and 2 revealed several challenges that participants faced during AL implementation. The challenges faced are as follows: -

##### 8.2.6.1 Challenge 1: Time

From the findings, the studies found that time is commonly indicated as the main challenge to the implementation of AL, especially with restricted duration during the period of a semester. This challenge on time limitation is commonly highlighted by several literature sources that indirectly hinder AL implementation (Ruiz-Gallardo, González-Geraldo, & Castaño, 2016; Yusof et al., 2015; Niemi, 2002). From the interviews, a majority of participants revealed that the AL implementation required more time during the learning and teaching process but, at the same time, they had limited time to finish the required syllabus as highlighted by one of the participants involved: -

*“The time is not sufficient, and we cannot do anything about it. But at the same time, you have to work to achieve it.”*

CS1-S19

This is due to the fact that the participants who adopted the AL approach normally required more time to prepare the necessary materials before the class. This finding is parallel with the quantitative data where 74.2 % of participants agree that time limitation is the most significant obstacle in AL implementation. In addition to this, 65.5 % of participants also agree that it is difficult to cover the entire syllabus using the AL approach within the limited time given. Thus, the time restriction faced by the staff to complete the syllabus sometimes forced the participants in Case Study 1 to revert to a teacher-centred approach. However, in the case of the findings from Case Study 2, some of the participants highlighted that time with the students was restricted due to their daily tasks, especially when the mentors are required to attend emergency cases which meant that they had to work beyond normal working hours. Thus, these situations had restricted the staff in effectively conducting the AL session as required by the approach.

#### 8.2.6.2 Challenge 2: Workload

With regards to this issue, the majority of participants from both case studies agreed that the higher workload had led to them not being able to implement the AL properly. As a majority of the staff are required to do other administrative jobs as well as to perform other responsibilities, the additional AL implementation work sometimes added to their workload. Thus, this similar situation highlighted by Simcock, Bronson, Mphande and Juan (2007) has indirectly discouraged them from employing the AL as instructed. In addition to this, some participants revealed that their high workload had caused them to experience stress when trying to do their work effectively and employ the AL properly. Hence, they tended to choose to do easy work rather than be burdened with the work that they were required to complete. In the case of the lecturers, as AL implementation required the staff to complete necessary preparation before the class, some of the participants preferred to use the traditional approach as a short-cut to complete the teaching as well as to finish the syllabus.

#### 8.2.6.3 Challenge 3: Lack of professional development

In implementing AL, it is also important to make sure that the staff possess the required competency in implementing the AL approach. Numerous studies highlighted the needs of training prior to AL implementation (Rasul & Yasin, 2014; de Graaff, 2013; Bouhuijs, 2011). As the findings from the studies revealed that a majority of the staff possess insufficient understanding of how to employ AL, this indicates that improper planning and insufficient training caused the situation to happen. Thus, it is vital to prepare the staff first before implementing any new approach as per requirements. At the same time, there is a need to

make sure that the staff have sufficient understanding and knowledge before the management let them implement the AL approach in their classrooms. This statement was agreed with 61.2% of respondents where one of the challenges faced by them is lacking an understanding of the AL used.

Despite having the advantage of experienced staff, it is also vital to provide necessary basic training, particularly with regard to their awareness of the implementation. As the implementation should involve all staff within the institution, proper planning of the training should be given priority in order to make sure that all staff are given the opportunity to attend and be involved. With regards to the training that is required for the staff, there should be a series of training sessions planned for them starting with basic pedagogic training and then moving on to specific training, such as communication skills, in order to enhance their capability to engage and communicate effectively with the students. In addition, their training should reflect the new AL requirements and should be updated periodically in order to align with the AL implementation; this will indirectly help to further improve their professional development as highlighted by the participants during interview: -

*“We need to be update with new teaching techniques or styles used in the class”*

CS1-S4

In addition to this, the management should undertake the serious preparation of all staff for the AL implementation and should not focus on a selected group, a practice that was found in the study. Hence, it is not surprising that the findings from the quantitative study revealed that a majority of quantitative respondents require additional training namely in the facilitation process (74.8%), managing students (75.1%), designing assessment (74.8%) and formulating learning materials (74.2%).

#### 8.2.6.4 Challenge 4: The Institute’s education system

In finding the answer to the challenges faced in implementing an AL approach, it is important to highlight that the institute’s education system should reflect the AL approach taken. Two important aspects that need to be highlighted in the context of the institute’s education system are the curriculum and assessment used which should reflect the AL approach as highlighted by Biggs (1999). Findings from Case Study 1 reveal that the curriculum and assessment still reflect a traditional approach even though the teaching and learning method used a specific AL approach. Hence it shows that, not all of the curriculum

was updated to reflect the AL approach used as some of the staff indicated that only certain subjects are suitable for adopting the AL approach. Hence, it is no surprise that some of the staff preferred to use a teacher-centred approach in delivering knowledge to the students. This is related to the findings from the survey where 63.4% of participants agreed that the previous educational culture hinders AL implementation amongst students. In addition to this, the use of an exam-based system does not tally with the approach used as much of the effort expended on the AL implementation was considered a waste of time by the staff and the students. Thus, assessment is an issue that needs priority consideration in order to carry out proper implementation.

### **8.3 Summary of the Analysis.**

Findings from the analysis summarise that the responses from both qualitative & quantitative studies show similar results on the several findings highlighted. The analysis done on both studies is then verified with existing literature for triangulation purposes. With regards to the factors that influence staff preparedness, the findings from the first theme 'Understanding' reveal that the ability of the staff to possess appropriate understanding plays an important effect on how the staff react towards AL implementation. This is due to the fact that the staff are able to understand his/her role and also what is expected to be achieved with regards to AL implementation. Findings from the second theme, 'Staff attitude' also play an vital effect in AL implementation. This is due to the fact that AL implementation requires additional tasks as compared to a traditional approach where it requires the staff to prepare more than just teaching materials prior to the learning and teaching process. Hence, it is important for the staff to possess a positive attitude in adopting the AL approach as highlighted by the findings. With regards to 'Training', the importance of preparing the staff through training and professional development is been highlighted by previous literature and study. Results from this study also align with previous studies that identify at least three types of training namely 'Introduction Training', 'Proficiently Training' as well as 'Professional Training' in order to prepare the staff towards successful AL implementation. Apart from this, it is important for the staff to be made compulsory on the listed training and a proper assessment should be made in order to make sure the staff are competent for AL adoption.

As for 'Facilities', findings from the analysis reveal that current existing facilities are not appropriate for AL implementation. Findings also identify that the institute should provide four types of facilities namely technology facility, learning space & infrastructures, teaching facilities as well as students learning facilities in order to align with AL implementation. This condition also links with to the related theme, 'Support' where AL implementation demands

full commitment from the management to support the implementation. Not only limited to the budget for proper implementation, preparing appropriate policies and frameworks are among other elements that may help the staff to be prepared in AL implementation. In addition to this, having good leaders may help to steer the AL direction where the theme 'Leadership' identifies that coordinating and monitoring is important in achieving successful AL implementation. Apart from this, having proper 'Planning' is vital as the success of AL implementation provides a meaning of the ability of the institute to manage the change with regards to the new adoption introduced. Thus, having proper planning that comprises all relevant stakeholders is important in order to make sure that each participant is ready and aware on each role towards successful implementation. To achieve this, 'Communication' is another important theme identified from the study conducted in order to make sure relevant participants are well informed on their direction.

Overall, findings from the qualitative study as well as quantitative survey has captured the idea of the actual AL implementation scenario within Malaysian engineering education and then confirmed with existing literature. Thus, the findings and relevant information may be used in the following chapter with regards to prepare the staff in AL implementation.

## **CHAPTER 9 : DISCUSSION**

### **9.1 Introduction**

This chapter provides a detailed discussion on the findings obtained from the field work done; both qualitative and quantitative studies where the primary focus of which was to investigate staff preparedness in AL implementation in Malaysian higher education. To help guiding the discussion, this chapter starts by providing an overview of the research work; by revisiting research questions that highlight the research purpose; followed by a brief summary of the methodology and the analysis used to generate the findings for this research work. The discussion is arranged based on the findings that will focus on how the staff responds to AL implementation. The discussion is done by interpreting and clarifying the results with reference to the literature reviewed and other relevant theory related to the research area. Finally, based on the findings, a framework of managing change for Active Learning Adoption is proposed. This framework could be used by any higher education institution interested in introducing AL in their teaching approach, as well as improving the existing approach.

### **9.2 Research Overview**

The main purpose of this study was to investigate Malaysian higher education staff perceptions of their preparedness for implementation an Active Learning (AL) approach within engineering education. The study was carried out to explore previous experience and current thoughts in order to gain further understanding of staff preparedness in introducing AL and the issues they faced during the implementation; analyse the influence of institutional culture and organizational leadership in supporting the staff with regards to AL implementation. In order to achieve the research objectives, this study employed exploratory sequential mixed-method design where qualitative exploration was done during the first phase through interview, focus groups and document analysis. In addition to this, data collection was conducted with three different stakeholders, namely the staff, management and the students, in order to validate the findings. These findings were generated from a qualitative study which was then been used to inform the development of survey instruments where a quantitative questionnaire was used to collect data from a larger sample of engineering educators. The second phase study was a quantitative description of engineering educators' previous experience and perception with regard to AL implementation in Malaysian higher education. Hence, data from both phases were then mixed with existing literature in the final analysis to support the discussion as well as to triangulate the findings.

### **9.3 The Major Findings of the Research**

In examination into staff perceptions of their preparedness on the AL implementation, the perceptions and experience of participants were determined by using an exploratory approach that involved both qualitative and quantitative study. Data from participants involved in this study were gathered in which the findings allowed for a shared perspective as a collective experience in informing the inquiry. In addition, the use of survey provides valuable insights with regards to staff preparedness in AL implementation in bigger a context.

With regards to AL implementation in a Malaysian higher education setting, the findings from the research shows that the staff support the idea of AL implementation, particularly within engineering education as they believe that AL implementation does help to equip students with the employability skills and competencies required in the current working environment. However, findings also revealed that the staff were reluctant to implement the AL approach as they viewed it as enforcement by the management and consequently were not confident to adopt the AL approach in their teaching and learning sessions. This situation was noticeable where the staff have had to implement the intended approach without having sufficient and necessary knowledge as well as the appropriate skills to do so. In other words, there is a lack of training given to the staff prior to the AL implementation that will prepare them for a successful AL implementation. The detailed findings also highlighted that the staff indicated the need for in-depth training from definition to practical implementation as the majority of the staff graduated from a didactic teacher-centered approach which is very different to the AL tenet. This evidence was confirmed by student interviews where they highlighted the inconsistency of the AL activities employed by the staff in the class.

Despite the lack of training given with regards to the AL implementation, the situation concerning AL adoption has failed to achieve the intended purpose as the staff are still struggling with the strategies and the support to adopt the AL approach in their teaching and learning. This result has led the researcher in identifying 10 key areas namely planning, leadership, communication, facilities, understanding, training, staff attitude, learning and teaching, support system and learning culture that contribute to the staff preparedness for successful AL implementation. Hence, evidence from these 10 key areas indicates that the success of AL implementation cannot solely depend on the staff changing their learning approach but it requires a holistic involvement from other stakeholders namely the management as well as the students. This can be seen from this research which also highlights the evidence of a polarised environment where it is required to achieve a better dialogue that will increase the level of understanding between the stakeholders involved in the

AL implementation. Based on the 10 key areas outlined, evidence from the study indicates that each stakeholder plays an important role / activity in order to achieve a successful AL implementation.

Hence, this study has led to an important finding and provided evidence to suggest that many cases it is the inability to manage the change in the institutional environment that hinder adoption of AL within the institute. In addition, as most of the educators in Malaysian higher education are from a teacher-centred setting, the change required by the AL approach has required not only the staff as the main agent in implementing the new way of teaching and learning to change, but it also demands the whole institution be involved in order to make sure that any changes undertaken within the institute are well addressed and embedded within the institutional culture.

Thus, the following section discuss on the key findings that have been identified during the research where it highlights the important factors which affecting the staff preparedness in implementing active learning within their institution.

#### **9.4 Discussion of Key Findings**

In this section, the discussion is based on staff experiences in implementing the specific AL chosen by their institute. The discussion will comprise of findings from qualitative and quantitative to find issues (which is mainly based on themes derived) where it has allowed for exploration of relationships in the data. It is important to note that the quantitative data used is not directly comparable with the findings in qualitative study as the findings from both case studies are more specific for exploratory research which cannot be generalised. However, the topic / issue as well as the elements discussed are used to validate the findings in qualitative work done. In other words, findings and discussion done are principally valid in the context of this research, however the findings can be worthy for other community consideration particularly within engineering education.

##### **9.4.1 Staff Perception**

In discussing staff perception with regards to AL implementation, the perception on AL approach is derived based on their collective experience on how well the implementation is adopted or being practiced during the teaching and learning session. Initial findings reveal that the staff are not convinced with the AL approach introduced to them as the majority of the participants are mainly graduated from a traditional didactic system where they depending on

a teacher to receive knowledge in the class. In addition, the majority of the staff are reluctant to change from their well-accepted practice to the technique that they are unsure on the effectiveness of teaching towards the student, apart from moving away from their comfort zone as recorded by Yusof et.al, (2004). This is aligned with work done by Bernstein, Tipping, Bercovitz and Skinner (1995) where he suggested that the success of AL implementation can only be achieved if the majority of staff are convinced of the need and have a desire to change.

However, the negative perception changed as the staff started to see the results on how the AL benefited their students. Results from the case studies show that the staffs' trust in the new approach increases when they see improvement in their students especially with regards to their generic skills. This is to align with current demand from industry of engineering graduates where the students are required to be competent with employability skills and not only depends on good academic grades (Rahmat, Ayub & Buntat, 2017; Radzali et al., 2013; Salleh et al., 2007). Hence, the acceptance of AL implementation gradually increases among the staff upon seeing that adopting AL approach in their teaching and learning improves students' critical thinking, communication skills, problem solving skills as well as team working abilities (Mellon et.al, 2017; Rahmat et al., 2017; Yasin et al., 2009).

#### **9.4.2 Factors Influencing Staffs' Preparedness Towards AL Implementation**

##### **Finding 1: Understanding**

In discussing staff understanding as one of the factors influencing staffs' preparedness towards AL implementation, the researcher would like to start the context by looking at the definition of AL itself. This approach (AL) is clearly an alternative to a didactic method as the AL approach requires the students to be actively involved by engaging them through discussion and presentation during the learning and teaching process (Prince, 1994). Apart from this, the AL approach also supports the tenets of constructivism where knowledge is co-constructed by the learners rather than transmitted to them (Cooperstein, & Kocevar, 2004). Therefore, in an AL environment, the role of the staff is no longer as knowledge provider as mentioned by Prince (2004) but to guide the students during the learning process or to facilitate their learning. Hence, findings in qualitative study revealed that those staff who were having problems gaining a clear understanding have created confusion on how they are supposed to run the AL correctly. This situation has resulted in various versions of AL adoption and some of the staff tending to give excuses about the implementation which consequently stopped them adopting an AL approach for their learning and teaching process. Similar results recorded by McGirr (2013) where the survey that he conducted indicated that inconsistency

in understanding of AL used has been identified as one of the challenges faced in embedding PBL as the underpinning methodological approach.

In relation to this, as most of the staff participants have come from a teacher-centred system, the majority tended to repeat the same learning methods that they had previously experienced which also contradicts with their role within the employed AL approach. Thus, in this case, their beliefs about the previous system had an effect on how they perform their role as a teacher, which is to distribute/transmit knowledge to their students. Towards the end of the implementation, most of them tended to spoon-feed the students as they thought this might help the students to find better answers. Thus, Borhan (2012) in his work asserts that preparing the staff for a new role in an AL environment is vital in order to make sure that the teachers or staff are clear about the pedagogic principles informing this approach. This finding is supported by Rasul & Yasin (2014) in their study regarding WBL instructors where having a good understanding is important in order to be aware of their responsibility in implementing WBL. Hence, for a proper AL adoption, the ability of the staff to possess a 'good understanding' of the AL used will indirectly influence how they react, which ultimately leads to either acceptance or rejection of this approach.

**Reflection 1:** The institutional articulation of AL used is essential in order to prevent confusion among staff (as well as students) as it is important that the whole institution commit towards the same practice and direction.

## **Finding 2: Staff Attitude Towards AL Implementation**

Since AL practice is new to the staff as compared to a teacher-centred approach, the staff role in the AL environment is becoming more challenging. This is due to the fact that the staff are required to prepare not only teaching material, but also other teaching aids that may help during an AL session. In addition, the staff role in the class is not as a knowledge provider anymore but it requires them to be actively involved during the teaching and learning session together with the students. In other words, it requires additional tasks which also creates pressure and becomes time consuming for them as compared to the previous traditional approach (Ruiz-Gallardo et al., 2016). Thus, staff who are comfortable with previously traditional of a one-way teaching style will find it difficult to adopt AL implementation as it requires a lot of preparation in an AL education setting. In relation to this, as a majority of the staff are also required to do other administrative jobs as well as to perform other responsibilities, the additional AL implementation work sometimes added to their workload (Simcock et al., 2007). Hence, the AL implementation is seen to be a burden to the staff and

this situation discouraged them from employing the AL despite admitting the advantages of AL implementation.

**Reflection 2:** As AL requires staff to change their attitude in order to value the implementation of the new adoption, it is important for the staff to revisit and rethink their professional ethos and roles in order to build awareness in their teaching practice.

### **Finding 3: Training for AL Adoption**

Evidence from previous studies has highlighted that training is one of the main requirements when any transformation is involved, particularly within education where a change in learning and teaching style is required (Rasul & Yasin, 2014; Radzali et al., 2013; Nopiah, et al, 2008;). In fact, it is one of the main criteria that should be taken care of in order to prepare staff for AL implementation. From the work done, there is much evidence revealing that there was insufficient training recorded for the staff prior to AL implementation. This includes the ability of the staff to know the concept behind the chosen AL, the rationale for implementing AL, the staff's role, type of activities involved during AL implementation as well as assessment used for AL implementation. Not limited to that, findings from this study also revealed that, there is no proper planning for continuous training provided to the staff with regards to AL implementation. Thus, this situation reflects the existence of improper training guidelines that fail to prepare them for the new approach. Hence, it is suggested that in preparing the staff towards AL implementation, training provided to the staff should at least consist of these three types of training namely 'Introduction Training', 'Proficiency Training' and 'Mastering Training'. In addition to this, the following discussion suggesting the timeline when this training should be conducted with regards to AL implementation. By preparing this training guideline, it is hoped that the guideline will assist the staff into the right direction of AL implementation and not seen as another 'trend introduced by the management that would come and go' as highlighted by Kamsah and Talib (2014) when, in their research another type of AL approach was introduced at their faculty.

**Reflection 3:** As AL implementation requires the staff to fully understand what is expected from them, a series of periodical training is vital in order to support the staff through professional development in the implementation of the new adoption.

Prior to AL implementation, 'Introduction training' is important to the staff as it is an 'introduction session' that provides appropriate awareness and to capture the staff's understanding with regards to the needs of AL adoption. In addition to that, the findings from

the interview also suggest that the training pertaining to AL adoption should be made compulsory for staff as agreed by 58.1% of survey respondents (Only 12.7% disagree on the statement while 29.2% are undecided). This is agreed by Igleton et al. (2000) in his finding asserts that among factors that are influencing the change of education system is by providing awareness on the effectiveness of AL adoption to staff as well as the students. In relation to this, it is also important to highlight that other constituents including students and management are also to be made compulsory to be involved in the awareness activity with regards to AL implementation. This suggestion is highlighted by Yusof (2004) where a bottom-up, top-down approach should be taken to promote AL approach in order to raise awareness as well as to educate the staff and the students. In other words, starting from the initial stage, the staff should possess a good understanding of how the AL approach fits into the required curriculum and consequently accepts the changes introduced. In addition to that, the involvement from all constituents is vital in order to make sure that all levels are aware and moving towards to the same direction and indirectly show their commitment in achieving the same goal.

**Reflection 4:** Introduction training; - Awareness training is a first step that prepares an organization for any changes taken. This is where the need of change and understanding the nature of the change is being emphasised. In addition, it is important to make mandatory for the staff to undergo the training provided in order to make sure full involvement from each staff.

Upon completion of awareness training at the initial stage, the next stage of training is where the staff should be given necessary information for AL proficiency & skill upon AL adoption where the skill is useful during the 'implementation stage'. Here, in implementing a new approach within an institute, it is important to make sure the staff are capable of employing an appropriate learning process in order to meet the learning outcome as required in AL approach. In other words, the key to successful AL implementation is to make sure the curriculum (its intended outcomes), the teaching methods used and the assessment used are aligned to each other. Hence, the researcher would like to correlate Biggs' Constructive Alignment Theory (1999) on how AL should be employed as per figure 9.1. This is due to the fact that once the staff has full understanding of the intended AL used as well as being clear on the learning outcome, the staff will indirectly be able to employ the learning process as per AL requirement.

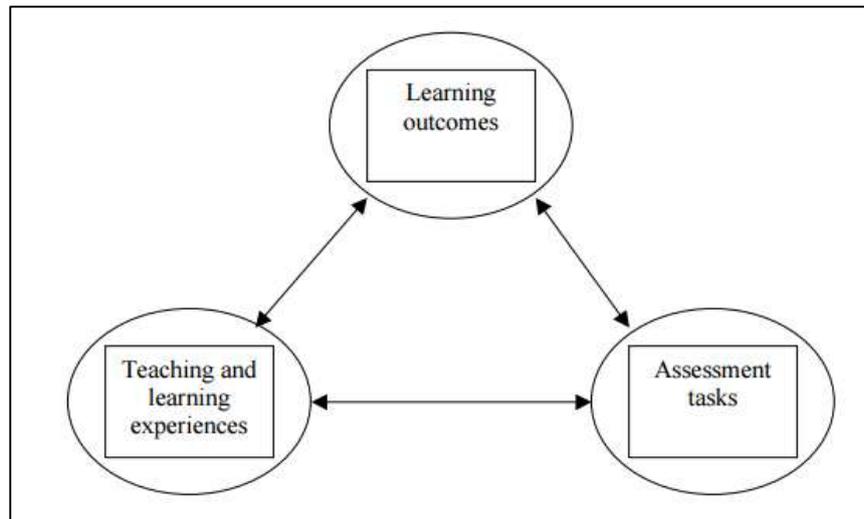


Figure 9.1: Biggs's Theory of Constructive Alignment (adapted from Biggs, 1999)

As AL approach differs with the didactic approach, the staff should be equipped for a new role as facilitator which is opposite to the function as a teacher. This is due to the findings from both case studies conducted show that the staff are not sure on how to perform AL approach as per requirement. Hence, Chan (2016) outlines that as a good facilitator, the staff should be able to fully understand their role as facilitator on how to provide guidance through the learning process, possess good understanding of AL approach, be open-minded and able to be a motivator.

In relation to the facilitation issue, as the AL process requires the staff to be competent in communication and another aspect of training that needs to be considered is the capability of the staff to possess necessary soft skills: such skills include communication skills as well as interpersonal skills which indirectly help to build their confidence in the learning and teaching process. Chan (2010) added that psychological skills may benefit the staff in being able to effectively handle adult learners. One solution here would be to provide staff with some compulsory pedagogic training which makes use of an andragogy approach focusing on adult learning.

Apart from a facilitation issue, it is necessary to train the staff to fully understand how the learning approach that they use aligns with the assessment that they conduct in order to achieve the learning objective(s) as highlighted in Biggs' Constructive Alignment Theory (1999). This is due to findings from Case Study 1 that reveal a majority of the staff do not know how to properly assess the students by using the AL they employ. Apart from this, it is important for the staff to clearly define how the assessment of the students should be carried out as some responses from the students indicate that the marks that they received do not

really reflect the activity that has been completed in the class. This is aligned with study conducted by Rahman et al. (2012) that highlighted selecting appropriate assessment is one of the factors that influences how effectively the students learn, particularly when the new approach is used. Buntat, Jabor, Saud, Mansor and Mustaffa (2013), in similar work, have also highlighted that among the constraints that staff face are those related to the existence of an insufficient curriculum and inadequate assessment, which enables the staff to understand clearly on the importance of AL implementation. Thus, assessment is an issue that needs priority consideration in training as it requires the staff to fully understand how the learning approach that they use aligns with the assessment in order to achieve the learning objective(s) as per Biggs' Constructive Alignment.

**Reflection 5:** Proficiency training; - Series of training that staff requires in managing the change of AL adoption. This is where the skill and competency is used during implementation.

While literature on training put emphasis on how the staff should develop their skill in AL implementation, it is also important to provide continuous support to retain the adoption. Blumberg (2008) had highlighted the difficulty in implementing as well as sustaining after extensive amounts of instructional change where not all staff that attended the training program apply it in their daily practices.

**Reflection 6:** Training for sustainability; - Professional training for mastery level that is required for sustaining the change.

**Reflection 7:** Apart from highlighting the importance of the training, the staff should not only attend compulsory related training but there is a need to be properly assessed in order to validate their competency. Hence, a proper assessment should be made as one of the compulsory requirements to effectively perform, and consequently be able to adopt their role.

#### **Finding 4: Management Support**

With regards to AL implementation, it is important to highlight that commitment from management is vital in supporting the change. As the AL implementation is an initiation that come from the management, thus the management should be responsible in making sure that any changes undertaken within the institute are well addressed and other stakeholders (i.e staff and students) are made aware of them. For instance, a clear vision and mission for the

AL implementation should be communicated to all related stakeholders (i.e staff and students) Once the mission and vision is understood, there should be a proper arrangement to make, in order to ensure that the objectives of the mission and the vision of the AL implementation are achieved. This includes providing some training, setting out any new rules and regulations as well as providing necessary facilities related to the AL implementation. For that, the management should be able to allocate the necessary budget to support the desired implementation which the new adoption requires necessary investment towards changing the new way of learning and teaching within the institute.

In assisting the staff to better prepare themselves in implementing AL approach, it is essential for the management to provide some guidance for the staff as well as the students in order to provide a clearer picture on the direction that they need achieve. This can be done by providing guidelines with regards to the AL that is about to be employed. In other words, the management support is crucial as it will portray how the implementation process is being done with regards to the AL approach.

**Reflection 8:** It is important to prepare a clear policy regarding AL adoption in order to assist the staff as well as the students for correct AL implementation (i.e Guideline for AL Adoption, Training Guideline). In addition, awareness on the guideline should be raised among the staff in order to avoid any misunderstanding of the AL practice.

Related to that, Yusof (2004) also stated administrative support from both department and institutional level are important in promoting and sustaining AL implementation as involvement of all levels within the institution will indirectly nurture AL adoption. This is aligned with a related study by Borrego et al. (2010), which also reveals the importance of the role of administration during educational innovation. Hence, all faculty members may provide their support by being involved during the adoption stage. For instance, if any issues arise on the shop floor, there should always be a person in charge or a team to refer to - a proper hierarchy needs to be set up and staff clearly informed of this. Thus, the staff will always feel that there will be a support system available for them to discuss any issue that arises. This situation is supported by Niemi (2002) where, in her study, it was shown that emotional support and an encouraging atmosphere are among types of support needed by staff in order to increase staff confidence particularly when a new approach is introduced.

**Reflection 9:** The multi - or interdisciplinary centralised support is evidence in supporting staff during AL implementation where it is necessary to provide both technical and pedagogical support.

### **Finding 5: Leadership**

Findings from this research study reveal that competent leadership has a direct influence in preparing the staff towards AL implementation. This is parallel to the results revealed by Kamsah and Talib (2014), where they point out that among the factors that contribute to an effective educational institution is good a leadership. As both case studies in qualitative findings reflect different results on how their institute deals with the changes during AL implementation, the findings strongly indicate that having a capable leader will affect the whole implication as it will reflect how the institution works as a team or vice versa. This finding also align with Kolmos (2010) where a good leader should be able to carry out the vision as well as motivate the changes. In addition, periodic monitoring and assessment by the leader on the AL activity with students as well as getting feedback from the staff indirectly provides a proper monitoring system where reflection on the approach taken provides a room for continuous improvement.

**Reflection 10:** In implementing educational change, there is a need in coordinating, monitoring and assessing on the activity done in order to make sure of successful implementation.

### **Finding 6: Planning**

In an effort to employ AL within the institute, engaging a proper plan is an important finding that is closely related to leadership. This condition indirectly reflects the time allocation with regards to the necessary preparation prior to AL implementation. For instance, Aldred (2003) addressed the challenges in preparing the staff and materials for Central Queensland University where the team spent over one year for PBL implementation. In related to that, Coffin (2013) highlighted that preparing the staff alone may take at least a year before the actual implementation. Thus, this situation highlights how proper planning is important in order to make sure that the staff involved are alert and ready for the change. In order to achieve this, availability of a framework may provide some guidelines to assist the staff for AL implementation within their institute. In addition to that, the framework should not only focus on the staff as the agent of change in AL implementation, but a holistic involvement from the management as well as the students, is vital in order to achieve effective AL implementation. Thus, in the framework, the planning should include the roles of each stakeholder and the elements that should be completed in order to attain successful AL implementation.

**Reflection 11:** There is a need to develop a proper framework in managing the change with regards to AL implementation that outlines some guidelines on each role for relevant participants in order to achieve the same goal.

### **Finding 7: Communication**

With regards to this finding, data from participants reveals that having good communication provides a significant effect in preparing the staff for AL implementation. For instance, findings in Case Study 1 reveal that information received regarding PBL implementation was not properly addressed to the staff as most of the information was delivered verbally among peers. Thus, the situation created misunderstanding on the information received. To overcome this issue, having a proper platform for discussion is needed, as 41.9% of quantitative findings agree that a proper platform to discuss AL implementation within the institution may ease communication (while 38.25% remain undecided and 19.8% disagree on the statement). In addition to this, findings also reveal that involvement from all levels as well as stakeholders is important in order to achieve the same direction.

**Reflection 12:** There is a need to develop a proper platform for discussion where issues on AL implementation should be heard from top-down and down-up, an effective solution can be carried out immediately.

### **Finding 8: Learning Culture**

From qualitative interviews, findings from both case studies reveal that the AL implementation was initiated in order to improve on the traditional didactic teaching approach by engaging with a new learning and teaching environment. In preparing the institute for proper AL implementation, it is vital to understand that the changes cannot be made by only giving instructions to related parties to implement what the management intended. One of the important elements that management needs to be aware of is the need to make sure that the surrounding environment should be transformed parallel to the approach. This is supported by Rahman et al. (2012), where they highlighted that the students' approach to learning is closely related to their learning environment. An effective learning environment affects the learning outcome in relation to the approach used. Thus, it is important to understand that the institutional culture does influence the implementation, not only the staff but the whole institution in general needs to be geared towards the change. Hence, to achieve this, it takes involvement from all constituents namely the staff, management and the students to change

the traditional approach and create a new way of learning with clear direction. In relation to this, Peterson and Spencer (1991) defined institutional culture as “the deeply embedded patterns of organisational behaviour and the shared values, assumptions, beliefs, or ideologies that members have about their organisation or its work” (p. 142). The statement indirectly means that the surrounding environment can be created in order to reflect what we want to achieve. As we are aware that it is hard to change the culture of people, it is still possible to make people change by creating a better environment, particularly within the institution. Thus, by creating necessary improvements in the surrounding environment, the AL implementation can be achieved effectively.

In Case Study 1, the majority of the participants admitted that their current environment does not support the AL implementation carried out as there was much preparation that needed to be completed in order to make sure that the whole institute was working in the same direction. For instance, the ignorance of some staff who were not using the AL approach as per requirement created dissatisfaction among staff which indirectly created a negative influence within the institution. As the implementation was based on verbal instructions from the management, no framework was available for the staff or related parties to check on any procedures involved in the implementation. Thus, this situation indirectly caused confusion among the staff on whether to keep employing the approach or revert to a traditional way of teaching.

**Reflection 13:** As the staff and the whole institution is in the middle of a ‘cultural change’, it is important to create an appropriate internal environment that supports the new approach. This is to make sure that all stakeholders are aware of the intended initiative and work together to achieve the goal.

### **Finding 9: Facilities**

In AL implementation, one of the common issues hindering proper AL implementation is related to improper facilities. Boles (2017) also added that factors such as an insufficient learning environment as well as inadequate learning support were among the causes that hindered successful of AL implementation in engineering education. In general, findings from this study shows that a majority of participants feel dissatisfaction on the issue raised. According to participants, the facilities provided within their institute do not align with the objectives of AL implementation, similar findings as highlighted by Hanapi Nordin and Khamis (2015) where the facilities provided were found to not tally with the learning purpose. Thus,

this condition caused confusion among the staff as the situation indirectly shows an opposite condition.

In an attempt to implement the AL approach, it is essential to provide appropriate facilities that align with AL adoption. Results from this study has identified four types of facilities as describes below:-

- a) Technology facilities - e.g. internet connection, necessary communication tools, etc.
- b) Learning space/infrastructure - e.g. classrooms, labs (with necessary equipment). etc.
- c) Teaching facilities (teaching equipment) - e.g. projector, white board, etc.
- d) Students' learning facilities – e.g. books, computers, discussion room, etc.

Based on detailed findings, the issue of technology facilities, such as the availability of sufficient internet facilities and computers, was one of the major challenges raised by participants. This is a similar finding to Ruiz-Gallardo et al. (2016) where 21<sup>st</sup> century students prefer to find knowledge from the internet rather than looking for information in the library. Shaari and Jusoh (2012) also added that outdated devices and insufficient infrastructure are other issues raised in connection with the introduction of new learning innovations. This includes that the learning space available did not support the AL approach as it still reflected a teacher-centred approach, particularly within the learning institution. However, as the limitation of the facilities provided as declared by Borrego et al. (2010) where it needs the allocation of a special budget, this perpetual issue is one of the main concerns that the management needs to consider for future AL implementation initiatives.

**Reflection 14:** Changes in technology has impacted how learning and teaching should be conducted by using latest learning innovations. Thus, the staff or students confirming experiences can be a bottom-up approach for change policy that improves facilities requirements. In addition to this, necessary allocation and planning by respective stake holders is vital if the AL implementation is still the priority of a new way for teaching and learning of the institution.

## 9.5 Development of Framework

In the search for establishing the appropriate key force underlying the change within higher education institutions, findings from the research highlights the importance of managing the change in directing the result as per expectation. Based on the study conducted, findings

from this research are in line with findings by Senge (1999) where he highlights the challenges faced by organizations in managing change. According to Senge (1999), failing to adapt the transition process caused by rejection from staff may cause failure in adopting the change required, particularly when a change initiative is being introduced in higher learning organization.

As the staff is believed to play a significant role as the main changing agent in introducing any new approach within higher education, they cannot be solely responsible for the changes required. The involvement of management is also vital as a governance structure in directing the result obtained in initiating the changes. Apart from that, the students who are the 'end user' of the new approach are indirectly involved as part of the organization structure. Hence, holistic involvement from the three main stakeholders within the institute, namely the staff, management and the students is vital, particularly in getting everybody to work and respond towards the same direction. This holistic involvement is the foundation associated with Senge's (1999) term of 'profound change' where it requires an organizational change that combines the inner shifts in people's values, aspirations, and behaviours with outer shifts in processes, strategies, practices and systems. Thus, the researcher believes that change initiative in education cannot be done individually without participation from the whole organization.

The following Figure 9.2 encapsulates the essence of the structural framework that initiated from this research work. The framework is designed based on Senge's work (1999) with some additional elements gathered from the research findings. While Senge's (1999) work highlights the challenges faced during the new approach of implementation, for this research work, the researcher considers the challenges before AL takes place & during implementation in constructing the framework. Therefore, the development of the research framework is to solve all the challenges been highlighted by Senge (1999) as well as the researcher's research findings. As the framework provides minimum guidelines prior to AL implementation, the framework is constructed in such a way that each stakeholder should focus on identified 'elements' that focus on certain criteria that each participant should possess at each stage towards successful AL implementation.

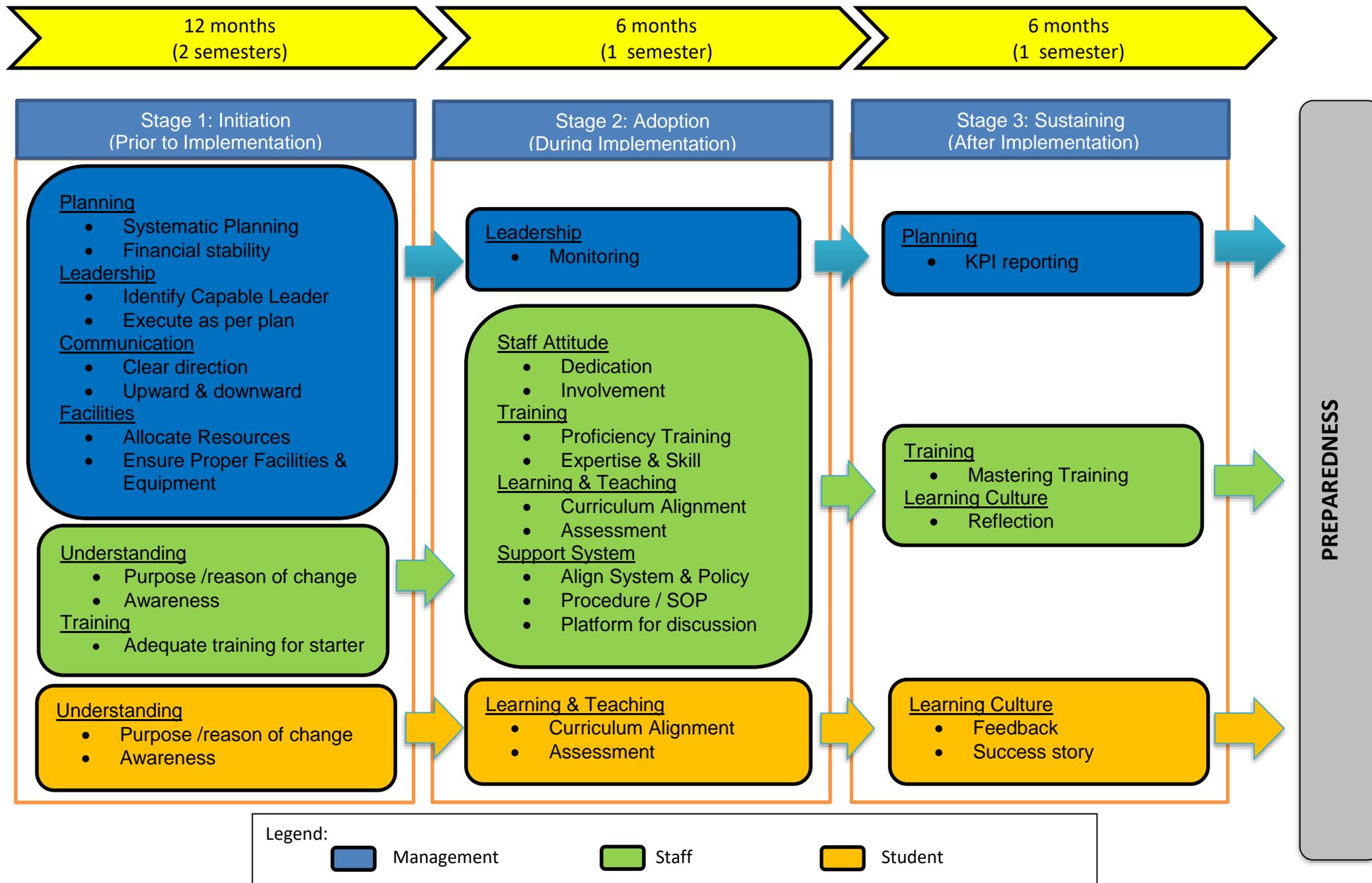


Figure 9.2: Framework of Managing Change for AL Adoption Process (Author)

Figure 9.2 highlights the structure of the framework which consists of 3 stages of adoption with 3 main stakeholders involved for AL implementation namely the management, staff and students. Several elements have been identified for each stakeholder to achieve at every stage in managing the changes required. For the purpose of understanding, the colour code is used to represent each stakeholder in the framework presented. Further information with regards to the framework is discussed in the following sub-section.

### **9.5.1 The structure of the framework**

From the study conducted, successful implementation can be achieved if related participants involved are able to deal with the transition period upon any changes made during AL adoption. The process of managing the changes requires participants to prepare and be able to understand the consequence of the changeover process which may take a period of time before adoption is introduced. In other words, any institution which has any intention to adopt AL should understand that AL implementation cannot be achieved 'within a day' or just simply by giving instructions to the staff. Adapting from Senge's work (1999) which identified 3 categories of challenges in initiating change, the researcher has used the information to identify three important stages which relate to the challenges highlighted by Senge (1999) that involved in dealing with change management. The 3 stages proposed are important in order to make sure the strategies planned are properly implemented where it helps relevant stakeholders to adapt required changes for effecting results. The 3 stages proposed are: -

#### **Stage 1: Initiating**

- Prior to any changes introduced, any action taken during the initial stage is vital in order to prevent challenges that might be faced by staff as highlighted by Senge (1999). Thus, having a proper plan is important as any changes cannot be achieved without proper planning being done. In other words, a proper planning is important to make the institute have enough time before actual implementation. In addition to this, the main purpose of this stage is to make sure that all stakeholders are aware on the 'plan for change'.
- In order to achieve that, the Management, who is the decision maker, plays an important role and is responsible at this 'Initiation' stage in proposing the change. Hence, the Management should develop a proper 'Change Management Plan' that includes all the stakeholders.

- The following elements suggest what each stakeholder is required to achieve during the initial stage as shown below: -

a) The Management

In running the higher education institution as a policy maker, the researcher has identified four elements that management are required to focus on with regards to implementation of new adoption within the institute. The suggested elements are:-

Planning

Before any changes are made, systematic planning is necessary where the management should consider every aspect related, starting from the initiation stage towards its implementation stage. Issues of financial stability is one of the main factors that the management needs to consider before any decision is made. This is due to the fact that any change involved requires additional cost as investment purpose.

Leadership

In preparing to change, it is essential to establish a proper team to lead the changes. Thus, the leader supported by the team should execute the 'managing change plan'. This is aligned with Senge's (1999) challenge to 'walk the talk' in introducing the AL approach. In addition, a policy or framework that outlines the required changes should be developed to assist the AL adoption.

Communication

One of the important elements in implementing change is by having proper communication where the idea of AL adoption is well disseminated from top to bottom. In addition to this, strategic communication is vital to build necessary understanding on the required change. It is also important to get appropriate support and commitment from all stake holders and at all levels towards the change.

Facilities

In implanting change within an educational institution, preparing necessary facilities is vital as it is indirectly a form of organizational support. As facilities are another main element that demands full attention of the management, it may require the special allocation of a budget where it is controlled at the decision maker level.

In optimum conditions, four types of facilities are identified as below:

- i) Technology facilities - e.g. internet connection, necessary communication tools, etc.
- ii) Learning space/infrastructure - e.g. classrooms, labs (with necessary equipment). etc.
- iii) Teaching facilities (teaching equipment) - e.g. projector, white board, etc.
- iv) Students' learning facilities – e.g. books, computers, discussion room, etc.

#### b) The Staffs

As the staff is identified as the enabling participant that execute and practises the changes (in case of AL adoption), it is necessary to equip them with necessary knowledge as well as essential skills and behaviour prior to AL implementation. Hence, getting appropriate understand and training are the most important elements that need to be emphasized for the staff at the very beginning of this stage and before actual implementation takes place.

#### Understanding

As for the staff, in an attempt to introduce any change in learning approach, it is necessary to build a good understanding among them on why the new practice is initiated. By having good understanding on why the change is needed, the staff awareness could be nurtured with regards to the new approach selected.

#### Training

In relation to previous elements highlighted, training is one of the most vital elements in order to prepare the staff in managing the change. Introduction training which focuses on appropriate knowledge as well as the skills required will indirectly help them to understand their role within the AL environment.

#### a) The Students

#### Understanding

As the students are also involved in adopting the new learning approach, it is important to make sure that they are included during the change process. Hence, providing appropriate information on why the change is essential for their learning process is vital in order to create better awareness on AL adoption among students.

With several elements highlighted above, the importance of this 'Initiating' stage is to make sure that all stakeholders are aware on the change initiative done (i.e AL adoption) where the whole institution should be informed on the new change required.

Thus, it is suggested that at least 12 months or 1 year duration being given before the new approach is totally adopted particularly for the management to make necessary preparation as highlighted above. In addition, the duration given is adequate to build necessary resources in building internal capacity for change.

### **Stage 2: Adoption**

- Once the first stage is clearly defined, the following stage is where all the strategies and plans will be executed.
- During this adoption stage (in case of AL adoption), the staff play an important role as they are the ones who are going to implement the changes required
- The following information highlights what are the elements that each stakeholder should accomplish during this 'Adoption' stage-

#### a) The Management

While the management role is more significant during the initial stage particularly in planning and providing necessary funding and resources, the management role is inevitably vital throughout the managing the change process.

#### Leadership

During AL implementation take place, staff monitoring is important at this stage in order to make sure that the planning done is put into realisation. In addition, the management should be able to control and manage resistance from the staff (if any) for successful implementation.

#### b) The Staff

Based on Figure 9.2, the following elements are important as they associate on how the staff should respond towards AL implementation during the adoption period. Thus, the elements highlight associates with the responsibility of the staff with regards to the AL implementation.

#### Staff Attitude

With regards to Staff Attitude, it is important to nurture the staff with positive behaviour towards the change imposed. In the case of AL adoption, necessary support should be done in order to keep the staff engaged with the new approach through necessary coaching and training.

### Training

During this stage, additional proficiency training is important in order to enhance the staff with additional knowledge, skills and abilities that align with AL requirements.

### Learning and Teaching

With regards to Learning and Teaching elements, it is vital to make sure that curriculum and assessment are aligned with the AL adopted as highlighted by Biggs (1994) in his Constructive Alignment theory. Thus, in implementing an AL approach, the staff should be able to reflect both curriculum and assessment in their learning and teaching process.

### Support System

At this stage, it is vital to make sure that the staff possess necessary support during the implementation stage as a way to hinder the resistance to change. Hence, having a proper platform or support group for discussion does help for proper implementation as it provides necessary assistance as well as motivation during AL implementation. Cooperation and team working must exist within the support element in order to make sure that the whole institution works in the same direction and aligns with the policy and goals.

#### c) Students

### Learning and Teaching

During this stage, the students should be able to experience the changes proposed earlier. Hence, they should be given necessary guidance with regards to the new approach used. In addition to this, the activities involved should clearly define what is expected from them and the activities involved reflect both curriculum and assessment process.

As this 'Adoption' stage focuses on actual AL implementation, it is advisable that the adoption process should take place at the beginning of the semester. Hence, the staff as well as the students are given approximately 1 semester or 6 months for the whole adoption to be completed in which it also will be based on the course offered within the semester.

### **Stage 3: Sustaining**

- The final stage occurs when the staff is required to use the new approach in all courses as their normal practice in teaching and learning.

- At this stage, involvement from all stakeholders is still important in order to make sure the AL adoption is continuously being implemented.
- Few strategies should be taken into account to cultivate continuous adoption and to sustain the implementation.

a) Management

Leadership

As for the management, continuous monitoring is important in order to make sure the implementation is well adopted in the following session. Hence, it is important for the management to include the AL adoption as compulsory criteria in assessing the staff KPI (Key Performance Index). Apart from this, the management should support the implementation by recognizing and appreciating the progress done with regards to the new approach.

b) Staff

Training

As for the staff, one of the ways to sustain the AL adoption is by providing on-going mastering training for their continuous improvement. This is to make sure continuous support to the staff and enhancement of their competency to sustain the change.

In addition to this, the following strategies can be considered on how the staff can be encouraged to sustain the implementation: -

- i) Recognition- award program (incentive). may help to reinforce the change particularly to the staff who deal with the changes required
- ii) Career development- providing appropriate promotion to the staff is one of the ways to encourage them for continuously adopting the change. Providing a new career path may help them to be actively involved in the change initiative introduced (i.e AL implementation)
- iii) Involvement in community of practice – In the case of AL adoption, staff should be encouraged to get involved in appropriate communities (i.e. engineering education community) that may help them to sustain the implementation. Support received from the communities may encourage the staff to overcome fear and doubt with regards to AL implementation. In addition to this, the information gathered from the community members may help the staff to be better prepared for AL implementation through knowledge as well as experience practice sharing during conferences, seminars or symposiums organized by the members.

### Learning culture

In the case of AL adoption, one of the ways to sustain the implementation is by conducting reflection sessions and evaluating the effectiveness on the new approach employed. This should be followed by necessary corrective action in order to make sure the approach reflects significant meaning into the learning and teaching process. Apart from this, any changes made should be embedded into the system or policy in order to make sure the implementation takes roots within the institution system. Hence, this action will indirectly build a culture within the institution environment with regards to the change imposed.

#### c) Student

### Learning culture

In creating a new learning culture for the students, it is important to listen to their feedback with regards to their experience in AL adoption as a way to further improve the teaching and learning process. In addition to this, by sharing several success stories related to the approach used within the institute, it may help the students to nurture and engage with the AL approach in their learning style.

With regards to managing the change in higher education institution, Senge (1999) suggests that in introducing new initiatives within higher education, the implementation may start off with a 'pilot group' before imposing the implementation for the whole organization. In this case, the success story of this pilot group may help to promote the adoption process as well as begin to take root within the organization culture. However, total support from related parties are important in order to make sure that the approach is success.

## **9.6 Conclusion**

In conclusion, this chapter has discussed the findings from both qualitative and quantitative work done that leads to the development of a framework that can guide staff in preparing themselves for AL adoption. Adopting from Senge's (1999) work and findings from the research done, the framework presented provides important elements as well as guidelines on how the staff could be assisted in managing the change with regards to AL implementation.

From the framework, it shows that in any change initiative made within an organization, a holistic involvement is important in order to achieve the change

introduced. However, the responsibility should start with the management as the policy maker where they should be responsible to make sure the changes required are clearly received by other stakeholders, apart from providing necessary resources required. In the case of AL adoption, as the staff are given the responsibility to perform the required change, preparing them with appropriate knowledge and skills is essential. Thus, it is important to understand that this framework provides guidance on how the staff is being prepared in managing the change with regards to the AL approach proposed. Hence, the time frame or phases outlined in the framework suggests an appropriate duration for the staff to prepare themselves prior to the AL implementation. In addition to this, the framework also outlines the element that each stakeholder namely the staff, management as well as the student should possess that may contribute to the success of AL implementation.

To summarise, the framework produced is a novel step in assisting the staff as well as the institute in managing the change towards AL implementation. In addition, the framework indirectly provides a minimum guideline for the whole institution to enable them to get ready for proper AL implementation.

The following chapter provides the conclusion and indicates the research contributions of this study as well as its limitations.

## **CHAPTER 10 : CONCLUSION**

### **10.1 Introduction**

This final chapter starts by revisiting the aim and objectives that motivate this research study before highlighting the contributions made to the field of AL, particularly for engineering education in Malaysia. The research limitations as well as suggestions for future research are also presented.

### **10.2 Answering the Research Questions and Achieving the Research Aim and Objectives**

In conducting this research study, the following main research question was addressed which particularly focused on the Malaysian higher education context: *How prepared are higher education staff to adopt an Active Learning (AL) approach in engineering education?*

To help answer this main research question, the following six research sub-questions were developed:

1. What are the staff perceptions of Active Learning as an approach in Engineering Education?
2. What are the factors that influence staff preparedness in AL implementation?
3. What mechanisms are in place to support staff who are introducing Active Learning?
4. How can organisational leadership influence staff preparedness in AL implementation?
5. How can the institutional culture influence staff preparedness in AL implementation?
6. What are the challenges faced by staff in implementing Active Learning?

The above questions were answered by accomplishing the research aim and research objectives of the study. As the aim of this research is to investigate higher education staff preparedness with regard to the introduction of an Active Learning (AL) approach within engineering education, a 'Framework of Managing Change for AL Adoption Process' was designed to guide and inform this implementation. Thus, the research aim was achieved through focusing on the following 6 research objectives:

- 1) The first objective was to analyse staff perceptions with regards to Active Learning implementation. In terms of this objective, the first phase of qualitative study that involved face-to-face semi-structured interviews were conducted with 37 staff/educators in two different case studies in order to capture their experience and opinions with regards to AL implementation. In general, the majority of participants are sceptical during early implementation of AL adoption. This was due to the fact that the majority of them were graduated from a teacher-centered approach that depends on the teacher as the knowledge provider. However, the staff perception started to change as they can see positive results portrayed by the students as compared to didactic approach. Results from quantitative survey by 353 Malaysian engineering educators shows a high mean value which represents positive perception with regards to AI implementation.
- 2) Based on 2 case studies conducted in qualitative phase, results from the analysis summarises 9 final themes that associate with the factors that influence the staff preparedness. The themes identified are understanding, staff attitude, training, communication, support, planning, leadership, culture and facilities. These factors are then transformed into a survey tool in order to get statistical data with regards to the issues discussed. In general, results from quantitative findings support the findings from qualitative phase with regards to the factors that influence the staff preparedness in AL implementation particularly in Malaysian engineering education.
- 3) In introducing the staff towards AL implementation, it is important to provide the staff with necessary staff development requirements or any related support prior to AL implementation. While the findings highlight the importance of training, there is no specific mechanism in place in guiding the staff to manage the change towards AL adoption. Hence, issues such as lack of training and guidance with regards to the AL tenet are commonly highlighted by the participants that hinder their preparedness toward AL implementation. In addition to this, issues of lacking support particularly from the management as well as other parties within the organisation had built up more challenges to properly adopt an AL approach. Hence, availability of a guideline or policy with regards to AL implementation may assist the staff to continually adopt the implementation.
- 4) In an attempt to implement a new pedagogical approach within higher education institutes, it is vital for the management to play their role as the policy maker in the

organization. Once the decision is made to adopt a new approach, appropriate planning is essential in order to make sure each step taken will produce a fruitful result. In the case of AL implementation, appointing a good leader is vital to lead the change within the organization. In addition to this, findings from the research reveal that having an appropriate system of communication is important in order to make sure any issues arising will be communicated well including from top to bottom level. Apart from that, proper monitoring is important in order to make sure of full involvement and commitment towards the implementation.

- 5) In analysing the institutional culture with regards to the staff preparedness in AL implementation, it is important to create an environment that aligns with the intended adoption. In the case of AL adoption, preparing appropriate facilities and resources are among significant effort that contribute to achieving proper AL implementation. As findings from both qualitative and quantitative phases highlights on inadequate resources with regards to AL implementation, the situation had caused confusion among the staff to adopt AL approach as their learning environment does not tally with their intended learning style. In relation to this, having involvement from all staff to fully participate in the same approach may nurture positive influence among them. This situation indirectly helps the staff to work together where colleague support is also important in order to achieve the intended learning approach.
- 6) In investigating the challenges faced by staff with regards to Active Learning implementation, results from this research are similar to the obstacles and challenges raised in the previous literature. Issue of time limitation, excessive workload, lack of profession development as well as the institute's education system are commonly raised in the study done. However, these challenges may be overcome if there is an appropriate framework that assist the staff as well as the whole organization properly manage the transition period well.

Finally, by answering the research questions, the above research objectives were attained and transformed into a framework of managing the change. With regards to AL adoption within Malaysian higher education which rooted from a teacher-centered approach, the staff should be properly assisted on how they manage the phase of change; from teacher-centered to the intended learning approach. However, the success of AL implementation cannot be solely attained by the staff themselves as it

also requires holistic involvement at all levels in order to make sure the change made will sustain within the organization as highlighted in the proposed framework.

### **10.3 Research Contributions**

#### **10.3.1 Contribution to Knowledge**

With regards to the findings of this study, this research study contributes to the current state of knowledge on AL implementation within engineering education, particularly in the Malaysian higher education context. As mentioned in the literature, there is presently a lack of research on the staff perspective with regards to their preparedness in AL implementation. Thus, this research manages to identify the key problems that hinder proper implementation with regards to staff preparation. In looking at the staff preparedness, this study is therefore important as it will add to the limited body of research in this area; in fact, it is the first study to be carried out within Malaysian engineering education in terms of focusing on staff preparedness for AL implementation.

In addition, this study identifies current problems in AL implementation and thus indirectly contributes to the increase in literature looking at how to improve educational practice, particularly within Malaysian higher education, by gaining understanding through exploration of the voices of the staff on how the institution in general assists them to better employ the tenets of AL. Hence, findings from this study may be used as reference and guidance, particularly in any effort taken to employ AL as a way to managing the change particularly in teaching and learning approaches in engineering education.

For this research work, the use of Senge's work (1999) pertaining managing change in higher institution learning is employed with regards to developing the framework will add current state of knowledge, particularly within engineering education. As results from the study conducted are found to be similar to the issues highlighted by Senge(1999), the information has provided meaningful insight as it outlines several important inputs that associates with the process of managing the change particularly for AL adoption within higher education institutions.

Apart from this, the variety of sources of data from this study, namely from the staff, from those at the management level, from students as well as from document analysis has provided different points of view to be heard by the institutions, policy

makers, teachers, higher education authorities as well as the research community in order to improve their knowledge, particularly with regard to the implementation of AL. In addition, this study also adopted quantitative approach to quantify on the issue that has been raised in the qualitative study. Hence, results from both approaches provide meaningful data with regards to AL implementation particularly within Malaysian higher education.

It is hoped that findings from this research study will stimulate both management and practitioners to check and verify the AL implementation status within their institute with regards to preparedness, thus helping to identify the necessary changes and improvements that need to be made to the adopted AL approach. Hence, dissemination of this work through publication of journals, papers presentation at conferences or seminars may benefit the community. Apart from this, a proposed guideline and framework may be instrumental to Ministry of Education reports on the work done to better improve AL adoption particularly within Malaysian engineering education.

### **10.3.2 Contribution to Practice**

A framework has been developed as an output of this study in managing the change with regards to AL implementation. While the intention of the framework is to focus on how to assist the staff to be prepared in managing the change in AL implementation, the successful implementation of the AL approach will not be fully achieved if only depending on the staff themselves. Thus, this research study has developed a comprehensive framework which highlights the role of three different stakeholders, namely the staff, management and the students in managing the change towards AL adoption. In addition to that, the framework also describes the elements and roles that need to be fulfilled by relevant stakeholders where each element outlines several activities that could be used as a guidance on how the staff (and other stakeholders) can be encouraged in AL implementation. Apart from this, a holistic view is vital for achieving the successful implementation of AL where this framework suggests mutual cooperation and support from all parties should be linked together in order to achieve the target. Thus, the framework provides a roadmap in managing the change through which it is also suggested for the need for total involvement from management, staff and the students within the institute in order to achieve effective AL implementation.

#### 10.4 Research Limitations

In conducting this research, there are several limitations that need to be considered. While the researcher has made an effort to overcome these limitations and constraints in order to maintain the quality of the research, the results of this study must be interpreted based on the following perceived limitations:

- a) As the number of Malaysian higher education institutes which have adopted the AL approach is limited, the selection of a sample which required the whole structure to focus on AL implementation restrained the sample selection. Thus, the institutes selected for this research study were the most representative available at the time the research study was conducted.
- b) As this research study was conducted in Malaysia where English is considered a second language, the majority of the participants preferred to use the Malay language instead of English during the research process. Thus, the researcher has made great effort to ensure the accuracy of the translations from Malay to English. However, it is possible that some translation errors may have occurred during the transcription process.
- c) There was some limitation on access to documents within the institutes involved in the study as some of the documents are considered confidential. Thus, this reduced the ability to confirm certain issues in connection to interview responses.
- d) Some cultural and political barriers were identified during the interviews which prevented the participants from revealing certain information, particularly when participants considered that such information was confidential; thus they were reluctant to share the information (This situation can be seen clearly in the survey done). In consequence, there may be some valuable but undisclosed information pertinent to the study that could not be included.
- e) As the coding of the transcript data was completed by the researcher with minimal verification from the supervisor, there may exist bias in the data analysis. In addition, the researcher's ontology as interpretivist may lead to an interpretation of the findings that would be different to others working with the same data.

## **10.5 Recommendations for further Research**

With the limitations outlined in the previous sub-section, the following recommendations are made with a view to stimulating better AL implementation.

- a) Future studies should be done in order to validate the framework construct and report on the findings and the effectiveness of the framework. Thus, through iterative research work the framework produced for this study may be improved upon.
- b) Future studies should consider a comparable AL model where exploring a common element will benefit the community.
- c) Future studies may consider AL adoption in other countries in order to see if any similarities or differences during the adoption process is taking place where the information gathered may benefit the community.

## **10.6 Summary**

This chapter presents the conclusions of the research work in the form of contributions this study makes to knowledge and practice in this field. In addition to this, the limitations of the study and recommendations for future research work have also been presented.

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