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An Explorative Study of Generic Skills Assessment Within an Active Learning Environment in Malaysian Engineering Education

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Doctor of Philosophy

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January 2017

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Aston University

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Thesis Summary

Teaching approaches in Higher Education are changing to meet the needs of 21st century employers. This is particularly the case in the field of Engineering Education (EE). Instead of teaching students with fundamental theories and ideas, active learning has been introduced as an alternative and integrated way of learning and teaching generic skills. Generic skills are equally important as academic knowledge and technical competencies achievement for students to possess as an outcome from Higher Education (HE). Graduates' generic skills are critical within contemporary society as employers require flexibility, creativity, initiative and multi-tasking. Generic skills include problem-solving, verbal/oral communication and team working. The assessment of generic skills is crucial in defining and articulating such skills.

The reliability and consistency of any grading system used to evaluate students' generic skills are the main issues in active learning, since the assessment is subjective and largely immeasurable. Within this context of study, constructivism influenced interpretivism underpins the researcher paradigm in conducting the research. This research adopted a multiple case study approach which is qualitative in nature, to generate an emergent theory. A combination of course documents and semi-structured interviews were utilised and focused within two case study organisations located in Malaysia. Data collection involving 14 academic staff, 16 students and ten employers was analysed systematically by searching and rearranging the themes emerging from the interview transcripts using the NVIVO software. The study involved carrying out empirical data collection processes in the selected institutes/universities particularly in the Engineering discipline (Mechatronics Engineering and Bio-Medical Electronics Engineering), which facilitated the process of generic skills assessment through different active learning approaches (Problem-Based Learning – PBL and Work-Based Learning – WBL).

The research contributes to the knowledge and practice of generic skills assessment within the active learning environment in the engineering discipline. From a theoretical perspective, it extends the theories of Constructive Alignment with Consensus Theory in Employability to improve the assessment of students' generic skills. Consequently, Higher Education Institutions/Universities and the Malaysian Ministry of Higher Education would be able to use the findings of this research to bring about assessment or curriculum change to help their students develop better skills as demanded by employers.

Keywords: Engineering Education, active learning and generic skills assessment

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List of Contents

List of Figures

List of Tables

List of Abbreviations

ABET	Accreditation Board for Engineering and Technology
AHELO	Assessment of Higher Education and Learning Outcomes
AL	Active Learning
AQF	Australian Qualification Framework
AU	Aston University
BBC	British Broadcasting Corporation
BEM	Board of Engineers Malaysia
BERA	British Research Association
CDIO	Conceive, Design, Implement and Operate
CGPA	Cumulative Grade Point Average
CLA	Collegiate Learning Assessment
CM	Concept Mapping
CPBL	Co-operative Problem-Based Learning
D&O	Demonstration and Observation
DEST	Department of Education, Science and Technology (Australia)
EAC	Engineering Accreditation Council
EE	Engineering Education
EI	Engineering Improvement
ENAEE	European Network for Engineering Accreditation
ESOEPE	European Standing Observatory for the Engineering Profession and Education
EUR-ACE	European Accredited Engineer
HE	Higher Education
IEA	International Engineering Alliance
ELT	Experiential Learning Theory
EPU	Economic Planning Unit
GMI	German-Malaysian Institute

HDU	Haemodialysis Unit
ILOs	Intended Learning Outcomes
JBP	Johor Bahru Polytechnic
LSC	Learning and Skills Council
MARA	Majlis Amanah Rakyat (People's Trust Council)
MCE	Malaysian Certificate of Education
MEES	Malaysian Engineering Employability Skills
MH	Melaka Hospital
MHSC	Malaysian Higher School Certificate
MoHE	Ministry of Higher Education
MQA	Malaysian Qualification Agency
MQF	Malaysian Qualification Framework
MUT	MARA University of Technology
NAE	National Academy of Engineering
NCVER	National Centre for Vocational Education and Research
NWEA	Northwest Evaluation Association
OBE	Outcome-Based Education
OECD	Organisation for Economic Co-operation and Development
PBL	Problem-Based Learning
PDS	Problem Definition and Solving
PjBL	Project-Based Learning
POPBL	Project-Oriented Problem-Based Learning
PPM	Planned Preventive Maintenance
PRO3BL	Problem, Project, Production-Based Learning
QAA	Quality Assurance Agency
RCM	Repairing Corrective Maintenance
SAH	Sultanah Aminah Hospital
SCL	Student-Centred Learning

SIH	Sultan Ibrahim Hospital
TAPPS	Thinking Aloud Pairs Problem-Solving
TAR	Technical Assessment Report
TJH	Tuanku Jaafar Hospital
TVET	Technical and Vocational Education Training
UICEE	UNESCO International Centre for Engineering Education
UK	United Kingdom
UK DfE	United Kingdom Department for Education
UKM	Universiti Kebangsaan Malaysia
UM	Universiti Malaya
UTHM	Universiti Tun Hussein Onn Malaysia
UTM	Universiti Teknologi Malaysia
UNESCO	United Nations Educational, Scientific and Cultural Organisation
USNA	United States Naval Academy
WBL	Work-Based Learning

1 Introduction

1.1 Chapter Overview

The chapter begins by outlining the background to the study and a discussion on the statement of the research problem as the basis for this thesis. The aims and objectives of this study are specified together with dissemination. At the end of the chapter the author includes the organisational structure of this thesis.

1.2 Background to the Study

The research is aimed at investigating the generic skills assessment within the active learning environment in the Higher Education sector of Malaysia, particularly in Engineering Education.

Generic skills are the skills that students need to become better, and more successful learners and effective practitioners in their fields of study, work and other aspects of their life – all of which are important to the outcome of a university education (Bennett et al., 1999; Biggs, 1999a; Allan et al., 2007; Ariffin et al., 2012). Similarly, generic skills are conceptualised by Cornford (2005) as skills applicable to different and varying situations faced after the learning and teaching process, adaptable to suit the varying needs of fresh situations. For the context of study, generic skills are defined as the skills acquired by the students as per intended learning outcomes during studies in Higher Education – aligned with the employer and labour market demands.

Active learning can be viewed in contrast to the traditional deductive approach of learning where students passively receive information from their instructor. Instead of teaching students fundamental theories and ideas, active learning may begin with a set of observations and experimental data to interpret, a case study to analyse, or a complex real-world problem to solve (Prince et al., 2006). The emphasis is more on students' learning and instructors are required to incorporate student-centred learning in more active ways in their courses or programmes (Shi et al., 2012). It is generally described as any instructional method that engages students in the learning process (Prince, 2004). Drake (2012) agreed with Prince, but added that in an active learning setting students need to be responsible for their own learning. While Felder et al. (2009) defined active learning as *"anything course-related that all students in a class session are called upon to do other than simply watching, listening and taking notes"* (p. 2). The most commonly cited definition of active learning comes from Bonwell et al. (1991) as: *"Involving students in doing things and thinking about what they are doing"* (p. 2). We may also be familiar with the ancient adage, *"Tell me and I forget. Show me and I may remember. Involve me and I will understand"* (Confucius, c.500BC). Although this is a seemingly simple statement, it makes complete sense from a learning and teaching perspective (Edwards et al., 2006).

Graduates who grasp generic skills competencies during studies have added value in their career development (Heitmann et al., 2009; Ariffin et al., 2012). Young et al. (2010) agreed and commented in their research: *“Employers who operate in global markets now seek employees who possess not only high-level technical or ‘job-specific’ competencies, but also, high levels of communication, problem-solving and conflict resolution skills”* (p.1). Therefore, in order to pursue their future careers successfully, students should be aware of employers' expectations of their having generic skills (Clayton et al., 2003).

In considering the application of academic skills, Jideani et al. (2012) argued that *“academic success is not in terms of what students can remember, but in terms of what students are able to do with their knowledge”* (p. 34). Yet, even though academic education and technical skills are two fundamental requirements of graduates, other non-technical and intangible generic skills are equally important (Briggeman et al., 2007; Saad et al., 2013). In discussing this issue Nilsson (2010) described Higher Education as an *“entrance ticket”* for professional employment and, as competition becomes higher, generic skills are often decisive in distinguishing graduates with the same educational background (p. 542).

In considering professional employment, Hamzah et al. (2009) suggested that any organisation’s portfolio should include the generic requirements for each job, so that prospective employees can take necessary steps to prepare themselves in terms of competencies (p. 688). In short, a lack of generic skills will ultimately affect an individual’s job prospects. The Chronicle of Higher Education suggests that many college level graduates lack job related skills (Johnson, 2011) and, a point made more relevant by reports, that one in three top companies cannot fill vacancies as many graduates leave university without the right skills (Harris, 2012).

Globalisation and rapid changes in technology have created the need for a workforce that not only has specialist knowledge and skills, but also has developed the generic skills needed to adapt quickly to new emergent technologies (UNESCO, 2012). With respect to these circumstances, education in the 21st century has had a considerable impact on the learning and teaching, as many Active Learning approaches adopted in Further and Higher Education institutions and universities, especially in the field of Engineering Education (Yusof, 2010).

It is essential for engineering courses to implement learning and teaching approaches that can help students to learn the content, while at the same time develop crucial generic skills

Mohd-Yusof et al. (2013). Instead of teaching the students with fundamental theories and ideas, Problem-Based Learning (PBL) is one of the active learning approaches that have been introduced as an alternative and integrated way in learning and teaching (Mohd Faiz et al., 2008; Masek et al., 2010b). Implementing PBL in teaching has significantly improved the students' recall of information, and help in the development of their personalities and attitudes (Prince, 2004; Dehkordi et al., 2008; Bell, 2010; Harasym et al., 2013).

Chan (2010) asked whether students are aware of what constitutes generic skills and how they fit into the curriculum (p. 4816). This question is further complicated by the terms of generic skills, e.g.: professional skills, soft skills, employable skills and transferable skills (Cajander et al., 2011). A comprehensive understanding of students' and lecturers' conception of generic skills and related learning approach experiences would help inform curriculum and assessment development (Biggs, 2003a). Therefore, this study will seek to collate knowledge on:

- generic skills assessment implementation
- the students' and lecturers' perceptions of generic skills assessment
- generic skills attribute of the graduates acquired by employers'

Pellegrino et al. (2001) described student assessment as a tool designed to observe students' behaviour and produce data that can be used to draw reasonable inferences about what is known (p. 42). Thus, there is a need to standardise assessment processes used in individual sectors while maintaining quality and sustainability. Benjamin et al. (2012) defined standardised assessments as being evaluations: *"in which the questions, the scoring procedures, and the interpretation of results are consistent and which are administered and scored in a manner allowing comparisons to be made across individuals and groups"* (p. 7).

Engineering Education around the world has witnessed a paradigm shift from being content-oriented to outcome-oriented, or from teaching to learning; the focus has moved from institutions, subjects and staff, to students and their learning process (Heitmann et al., 2009). Heitmann et al. 2009 also added that active learning approaches – mostly project organised, problem-based and student-centred – are increasingly being registered since then (p. 1). The next section will discuss engineering educational culture and its implications for Active Learning (AL) and acceptability, specifically in the Malaysian context.

1.2.1 Engineering Education in Malaysia

In Malaysian Engineering Education, many engineering undergraduates come from an exam-oriented schooling system that lacks the ingredients to develop both sufficient content and generic skills (Mohd-Yusof et al., 2004; Salleh et al., 2007). Accordingly, several researchers in Engineering Education have found that the current educational systems and practices in Malaysia are unable to provide the necessary generic skills needed by industry (Kamsah, 2004; Gurcharan Singh et al., 2008; Zaharim et al., 2008). In particular, according to Juhdi et al. (2007) engineering graduates are well equipped with technical skills, but they lack generic skills, such as an ability to communicate and solve problems, and they have poor interpersonal skills. These skills are not only demanded by employers but also the accrediting professional bodies.

In Malaysian HE, the International Engineering Alliance, IEA (2013) highlighted the need for a set of standardized outcomes to use in learning (learning experiences) to assess whether students have acquired competences and skills to the appropriate level (p. 2). Similarly, the Ministry of Higher Education (2012) emphasised that graduates need to possess the right attributes and represent those skills in order to secure employment and survive longer in industry.

Accordingly, Malaysian HE has consistently instructed their institutions and universities to cultivate generic skills in students. The Engineering Accreditation Council (EAC) Manual and Malaysian Qualification Framework (MQF) also focuses on generic skills and requires engineering graduates to gain particular attributes and competencies (see Table 1-1) (MQF, 2011; EAC, 2012; Yusoff et al., 2012). Acquiring these attributes and competencies, increase graduates' probabilities of securing a job.

The Malaysian Ministry of Higher Education (MoHE), EAC, the Board of Engineers Malaysia (BEM) and the Malaysian Qualification Agency (MQA) introduced an Outcome-Based Education (OBE) as an educational system in 2008. Signatories become a fully signatory member of a multi-national agreement for the mutual recognition of engineering degrees, e.g. The Washington Accord, Accreditation Board of Engineering and Technology (ABET) (Basri et al., 2004). The traditional approach in teaching where lecturers just give lectures and have the students memorise concepts and theories is no longer relevant (Yasin et al., 2009). OBE has brought about a significant paradigm shift from teacher to student-centred learning and a passive to active learning environment in education and training in the Malaysian education system (MQA, 2008; Abdullah et al., 2009). The contributing factor for the curriculum transition is the increase in number of unemployed graduates each year identified to be lacking generic skills (Shaari et al., 2012). Table 1-1 shows the attributes required by EAC and Table 1-2 lists the domains of the learning outcomes in the Malaysian Qualification Framework (MQF).

Table 1-1 Engineering attributes required by EAC (Malaysia) (EAC, 2012)

No.	Attributes
1.	Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialisation to the solution of complex engineering problems.
2.	Identify, formulate, research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3.	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.
4.	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.
5.	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.
6.	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.
7.	Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.
8.	Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.
9.	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.
10.	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
11.	Recognise the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.
12.	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 multi-disciplinary environments.

Table 1-2 Eight domains of learning outcomes in 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

There has been increasing interest in adopting AL in Malaysian Higher Education institutions based on the perception and trust that it assists students to acquire technical knowledge and generic skills (Krishnan et al., 2009; Yasin et al., 2009). However, most of the AL initiatives have been applied within a specific programme of study or course, rather than via full institutional adoption. For example, the move to implement Problem-Based Learning (PBL) at the Universiti Teknologi Malaysia (UTM) was initiated in 2002 and later it introduced Cooperative PBL (CPBL) in 2010 in the Department of Chemical Engineering (Mohd-Yusof et al., 2005; Mohd-Yusof et al., 2011). Additionally the University Malaya (UM's) initially attempted to implement PBL for second-year students during the 2003/2004 session in the Department of Electrical Engineering (Said et al., 2005). Likewise, the University Tun Hussein Onn Malaysia (UTHM) adopted PBL in 2005 in the Faculty of Civil and Environmental Engineering, and Faculty of Electronics and Electrical Engineering (Salleh et al., 2007). A number of Work-Based Learning (WBL) programmes were offered in 2007 in the Community Colleges followed by Polytechnics in 2010 (Rasul et al., 2014). Similarly, the University Kebangsaan Malaysia (UKM) introduced PBL in the second semester of 2007/2008 to improve generic skills in the Statistic Engineering course (Nopiah et al., 2009). In 2009, Malaysian polytechnics introduced Problem-Oriented Project-Based Learning (POPBL) in the Engineering programme in Electrical, Civil and Mechanical Engineering (Yasin et al., 2009); whilst in 2010, the German-Malaysian Institute introduced Problem-, Project- and Production-Based Learning (Pro3BL) in the first semester of 2010/2011 in the Industrial Electronics programme (Muhd-Zin et al., 2013).

Much research has been done to reflect on the implementation of active learning in Malaysian HE, especially in the engineering discipline. From the students' perspectives, Mohd-Yusof et al. (2004) reported students facing active learning for the first time, receive a shock when they are handed back responsibility for their learning. However, after they become familiar with the idea, they recognise the benefits of active learning, especially in enhancing their team-working skills and dealing effectively with disagreements and conflicts of opinion (Nopiah et al., 2009; Muhd-Zin et al., 2013). Salleh et al. (2007) found that students become more competent, not just in the content area but also the generic skills. The students appreciate that they are given the opportunity to think and explore on their own, realised the skills and positive attitudes gained (Mohd-Yusof et al., 2005, pp. 180-181), understand the importance of changing their perspective about learning (Othman et al., 2009), which results in enhancing their knowledge and critical-thinking ability (Masek et al., 2010a).

From the lecturers' perspective, initially they are afraid of adopting active learning because they have never experienced it themselves (Mohd-Yusof et al., 2004). However, after they have attended talks and training, it is acknowledged as an ideal approach for teaching engineering, as it is seen to possess many parallels with authentic engineering project cycles encountered in an engineer's career (Said et al., 2005; Mohd-Yusof et al., 2011). Salleh et al. (2007) discovered that lecturers gain greater satisfaction in seeing the students play a more active role in their learning and this makes their teaching more interesting, although the teaching preparation is quite challenging (p. 5).

1.3 Statement of the Research Problem

International engineering projects and collaborations have become common and are increasing everywhere in the world (Riemer, 2007; Kranov et al., 2008). Graduates' generic skills are ever more critical and important for becoming global engineers (Kassim et al., 2010; Nilsson, 2010; May et al., 2011). The demand for multi-skilled graduates is also increasing as technology becomes ever more advanced (Zaharim et al., 2010). Mason et al. (2011) reported in the 2009 National Employer Skills Survey that 67% - 72.5% engineering employers in the UK required HE to update and improve graduates' generic skills (p. 31). Mason et al. (2011) findings clarified that the main factors driving these changes in skill requirements are the introduction of new goods or services, new work practices, new technologies and new legislative or regulatory requirements (p. 29). Hence, graduates are now required to be equipped with updated technical knowledge and generic skills to survive in the challenging industry – and in order to become a 21st century international engineer.

Researcher literature in Engineering Education has discovered that employer criteria in selecting potential engineers, depends not only on academic and technical knowledge but also on generic skills, and in fact that is the differentiating factor (Lowden et al., 2011; Mason et al., 2011; Saad et al., 2013). Therefore, engineering courses must develop in line with the real and constantly evolving requirements of industry (RAE, 2007).

There is a general opinion that HE students should develop professional skills, e.g. soft skills, generic skills , and employable skills, and be able to demonstrate them as they enter the work environment in engineering disciplines (Cajander et al., 2011). In educating students with generic skills, Ballantine et al. (2007) argued that *“the approach is flawed insofar as it fails to provide an adequate understanding of the relationship between Higher Education and graduate employment”* (p. 127).

Higher Education as the policy maker and stake holder should play a role in increasing graduate employment opportunity. Learning outcomes, teaching pedagogy, assessment and curricular outcomes need to be aligned (Biggs, 2003a). Ramsden (2003) agreed and described from students’ point of view *“assessment always defines the actual curriculum”* (p. 182). The curriculum should align with the employer and labour market demand because they are the “end user” of graduates (Selvadurai et al., 2012). The assessment of generic skills involves well-informed professional judgements by assessors and assessor teams, including teachers and experts in the workplace (Curtis, 2004). In discussing this, Benjamin, Miller, et al. (2012) stated that *“skills, like written communication, problem-solving, and analytic reasoning, are learned – and assessed – best as they are applied in a discipline”* (p. 25).

Current Engineering Education shows that active learning has become the favoured approach, as student-centred approaches among the Higher Education sector in learning and teaching are mainly pedagogic (for example, see Lehmann et al., 2008; Hosseinzadeh et al., 2012; Lei et al., 2012; Shi et al., 2012). One of the student-centred examples is the Problem-Based Learning (PBL) approach (Kolmos, 2010; McFalls, 2013; Mohd-Yusof et al., 2013). However, Kolmos (2010) argued, that even if theories, research results, and experiences point in the direction of student-centred learning, the change process is difficult (p. 2). Ibrahim (2007) agreed and added it is more difficult if the promised benefits do not come immediately or automatically (p. 12). Therefore, Thomas (1997) suggested institutions adopting any active learning approach, especially PBL, need to have standardisation in their approach in learning and teaching, both in assessments and curricular-based roles. Abdul-Ghaffar et al. (1999) agreed with Thomas, adding that it is important to standardise and internationalise all components of validated PBL curricula to see its rationality, and to promote ease of implementation (p. 140).

Generic skills assessment is very subjective and hard to measure because it relies on the lecturer’s observation – whether or not the student has the attributes reflecting the intended skills (Ramsden, 2003; Shuman et al., 2005; Cajander et al., 2011). Assessment results can only be predictive of a certain potential, and determining whether a student has achieved an intended level of a generic skill requires lecturers' perception and observation of the students' performance in a multitude of diverse situations (Morreale et al., 2011; Yusoff et al., 2012). Bell (2010) and Prince (2004) agreed and added that data was less frequently available for these outcomes than for the standard measure of academic achievement. There is no clear way for assessing generic skills on engineering programmes. Therefore, generic skills assessment within an active learning environment is a gap that needs to be filled. This thesis intends to study the issue and design a framework according to the results of the research.

1.4 Research Question

The main question in this research is: **'How are generic skills assessed within an Active Learning (AL) environment in the Malaysian Engineering Education?'** The importance of these skills is often driven at national level by accreditation requirements such as those of the Accreditation Board for Engineering and Technology (Felder, 1998, pp. 126-127; ABET, 2009) in the United States, Australian Qualification Framework (AQF, 2013), Malaysian Qualification Framework (MQF, 2011) and Quality Assurance Agency in the United Kingdom (QAA, 2008). It is also acknowledged by employers that generic skills are critically important in the engineering discipline (in the UK and abroad; see, for example, Zaharim et al., 2009, p. 199; Blom et al., 2011, p. 15; Mason et al., 2011, p. 29; Yusoff et al., 2012).

This study is focused on the context of Engineering Education and AL environments, and only relates to engineering students and lecturers/mentors. In order to examine closely the relevant issues, five sub-research questions are provided as follows:

1. How is AL being implemented?
2. How is generic skills assessment implemented?
3. What are the lecturers'/mentors' experiences of generic skills assessment?
4. What are the students' experiences of generic skills assessment?
5. What generic skills attributes do employers expect engineering graduates to possess?

1.5 Aim and Objectives of the Study

The aim of the study is to investigate generic skills assessment within an active learning environment in the Malaysian Engineering Education. To provide answers to the research questions, the following objectives will form the focus of this research work:

- To critique the existing methods of assessing generic skills in the context of Engineering Education within an AL environment based on the literature.

- To collect data from two case study institutions in a range of different forms that then allows the integration of this data with the literature.
- To develop a framework to guide the assessment of generic skills in an AL environment.

The significance and importance of this research can be stated as follows:

- The generic skills assessment framework can contribute to students' awareness of the attributes of required generic skills. Similarly, it may contribute to guide academic staff practice when assessing generic skills in the context of Malaysian HE institutions (paying attention to the field of engineering including: problem-solving, verbal communication and teamwork).
- By determining students', academic staff and employers' experiences of generic skills, the research findings to enhance the standardisation and the reliability of generic skills assessment in Engineering Education (EE) institutions generally to meet the designated learning outcomes, HE standards and employer expectations.
- It contributes to the knowledge of active learning in engineering by addressing the gap that has been suggested by several authors (Nopiah et al., 2009; Cajander et al., 2011). Mai (2012) strongly suggested further research to ensure HE and employers can agree and align which generic skills attributes students should develop in HE institutions and what they need to know and should be able to do in the workplace. This knowledge would help to match educational goals with the expectation of industry.

1.6 Dissemination

Below are the lists of works that have been completed by the researcher throughout his study:

1. "How effective is the assessment of generic skills gained by Technical Vocational and Education Training (TVET) students engaged in Problem-Based Learning (PBL)? – A Literature Review" paper has been presented twice, in the 1st Engineering Education Research Special Interest Group (EER SIG) Symposium, in Loughborough University on 18th June, 2013 and during the 4th International Research Symposium on Problem-Based Learning, in Putrajaya, Malaysia on 2nd July 2013. The paper has also been published in PBL Across Cultures (Mohd-Yusof et al., 2013, pp. 88-94). Refer to **Appendix 1**.

2. "Students' Perceptions of Generic Skills Assessment Experiences within an Active Learning Environment in Malaysian Engineering Education – The Emerging Findings"

has been presented in the Aston University Learning and Teaching Forum on 27th November 2014. Refer to **Appendix 2**.

3. “Lecturers’ Experiences of Assessing Generic Skills in an Active Learning Environment for Engineering Education in Malaysia – Emergent Findings” has been presented during the Research in Engineering Education Symposium (REES) 2015, in the Dublin Institute of Technology on 13th July 2015. Refer to **Appendix 3**.

4. “Employers’ Perceptions of Generic Skills of Active Learning Experienced by Graduates in Malaysian Engineering Education – The Emerging Findings” has been presented during the United Kingdom and Ireland Engineering Education Research (UK & I EER) Network Symposium, in the University of Cambridge on 6th November 2015. Refer to **Appendix 4**.

1.7 Organisational Structure of the Thesis

Figure 1-1 outlines the structure of the thesis. Chapter 1 provides an introduction to the research topic. Chapter 2 reviews the literature of generic skills development with its assessment. It also discusses Active Learning (AL) approaches within the literature. The research methodology is presented in Chapter 3. Chapter 4 presents the findings from Case Study 1 which adopted Problem-Based Learning (PBL) as its learning approach. Chapter 5 presents the findings from Case Study 2, looking at a different approach of AL (Work-Based Learning – WBL). Chapter 6 describes the similarities and differences in the findings of both case studies. Chapter 7 provides discusses the research findings. Chapter 8 concludes the study, detailing limitations, contributions to knowledge, practice and theory. The chapter ends with notes for practitioners and proposals for further research.

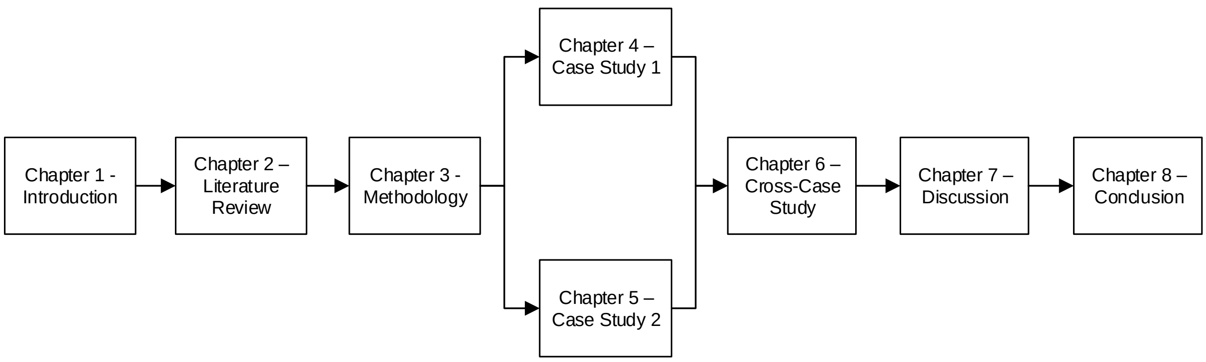

Figure 1-1 Structure of the thesis (Source: author)

2 Literature Review

2.1 Introduction

This chapter aims to analyse the background (within accepted literature) of the assessment of engineering students' generic skills within AL environments. To achieve the above aim, the literature review begins with discussing the terminology of generic skills, competencies and attributes used in engineering perspectives. This is followed by discussing generic skills (problem-solving, verbal communication and teamwork), starting with the importance of these skills in the workplace, the definition of each skill and ways to develop these skills, along with their challenges. Then, the next part of the chapter discusses generic skills assessment methods and the problems faced in verifying assessments within AL. The chapter continues with employers' perceptions, followed by a description of the AL approaches adopted in Engineering Education. Lastly Constructive Alignment Theory and Consensus Theory of Employability are presented.

2.2 Terminologies of Generic Skills, Competencies and Attributes

A skill is defined as an ability to perform a specific task (Cleary et al., 2006). In the engineering context, there are considered to be two types of complementary skill sets, namely, technical or hard skills and non-technical or soft skills (Abdulwahed et al., 2013). Hard skills normally refer *"to technical procedures or practical tasks that are typically easy to observe, quantify and measure"* (Shakir, 2009, p. 309). The terms "skills" and "competencies" are sometimes used interchangeably (Abdulwahed et al., 2013). However, Maceiras et al. (2011) argued that "competency" is a higher-level term than "knowledge" or "skill": competencies involve the ability to draw on and mobilise skills and attitudes in a particular setting to meet complex demands (p. 17).

Competence is defined by the Engineering-Council (2013) as the ability to carry out a task to an effective standard after a combination of formal and informal learning, and training and experience. The Organisation for Economic Co-operation and Development, OECD (2002) described competencies as the ability of an individual to undertake complex demands in particular situations and contexts, for example in both the immediate surroundings and the larger socio-economic and political environment (p. 9). The OECD classified competencies into two categories: key-competencies and specific-domain competencies. Key-competencies are defined as *"the competencies that enable individuals to participate effectively in multiple contexts or social fields, and that contribute to an overall successful life for individuals and to well-functioning society"* (OECD, 2002, p. 10). On the other hand, specific-domain competencies are those which *"do not apply across multiple relevant areas of life, are not* *necessary for everyone, or are irrelevant to the betterment of individual and societal life"* (OECD, 2002, p.10). While the OECD coined the term key-competencies, in other literature the terms "generic skills" or "generic competencies" are used, with the same meaning (Male et al., 2005; Hager et al., 2006; Abdulwahed et al., 2013; Puteh et al., 2013).

Researchers and educators also refer to skills other than technical- and engineering-related competencies as being soft skills (Azmi et al., 2012; Mai, 2012), professional skills (Shuman et al., 2005; Å. Cajander et al., 2011) and employability skills (Zaharim et al., 2010; Lowden et al., 2011; Yusoff et al., 2012; Paadi, 2014). According to Male et al. (2005) and Patil et al. (2009) they are often called graduate attributes.

Barrie (2007) envisaged graduate attributes as *"being the skills, knowledge and abilities of university graduates, beyond disciplinary content knowledge, which are applicable in a range of contexts and are acquired as a result of completing any undergraduate degree"* (p. 440). In short, Bowden et al. (2000) described graduate attributes as the qualities, skills and understandings a university community agrees its students should develop during their time in HE. However, the IEA (2013) highlighted that graduate attributes should be assessable to indicate that graduates' have the competencies to practice at the appropriate level.

The terminology used to refer to generic skills also differs from one country to another. National Centre for Vocational Education Research, NCVER (2003) and Abdulwahed et al. (2013) highlighted various terms including: "key skills" or "core skills" (United Kingdom); "key competencies", "soft skills", or "employability skills" (Australia); "essential skills" (New Zealand); "transferable skills" (France and Switzerland), "employability skills", "soft skills" or "generic skills" (Malaysia) and "necessary skills", "employability skills" or "workplace know-how" (United States).

The above terms can all be thought of as synonymous or hyponymous (Bowden et al., 2000). Kearns (2001) in his review of generic skills research studies in the UK, the United States and Australia concluded that there is no international agreement regarding terminology. This thesis, however, will refer to these skills as generic skills. This is due to the understanding that such skills are common in all branches of learning. Table 2-1 presents, in chronological order, other researchers' definitions of the term generic skills. The definitions contain three similar elements, which are: an outcome of HE, developing skills, and preparation for work employment.

Table 2-1 Definitions of the term generic skills by prominent researchers (Source: author)

Researchers	Definition of Generic Skills
Bowden et al. (2000)	The qualities, skills and understandings a university community agrees its students should develop during their time with the university.
Mulder et al. (2007, p. 69)	The common abilities that explain variations in performance which can be applied to different professional groups and workplace context.
ILO (2009)	The required skills by everyone as preparation for work and as an advantage by making them attractive to employers.
Abdulwahed et al. (2013)	The skills that students need to become more successful learners and successful practitioners in their field of study, work and other aspects of their life are an important outcome of university education.
IEA (2013)	A set of individually assessable outcomes that are the components indicative of the graduate's potential to acquire competencies to practice at the appropriate level.
Singh et al. (2014, p. 316)	A set of achievement skills, understandings and personal attributes that makes graduates more likely to gain employment and be successful in their chosen occupations, which benefits themselves, the workforce, the community and the economy as the outcome from HE. They are generally skills that cut horizontally across all industries and vertically across all jobs.

2.2.1 The Importance of Generic Skills

The importance of generic skills in Engineering Education is covered from many perspectives in the literature. However, this section only highlights the importance of these skills from educational and employer perspectives, which emphasise the need for graduates to acquire them.

2.2.1.1 From the Educational Perspective

Due to the multi-dimensional workplace nature of the engineering profession, engineering graduates are required to acquire adequate "global" competencies from educational programme outcomes (Patil et al., 2008). For that reason, most of the education policies around the world (Curtis, 2004; QAA, 2008; MQF, 2011; AQF, 2013) and standard accreditation organisations, such as the Accreditation Board for Engineering and Technology (ABET, 2014), the EUR-ACE accreditation framework of the European Standing Observatory for the Engineering Profession and Education (ESOEPE) (ENAEE, 2009) and Engineers Australia, have indicated that it is compulsory for graduates to attain generic skills as an important outcome of Higher Education (Felder, 1998; Patil et al., 2008). A set of minimum requirements were made for students to acquire as an outcome of their study in HE.

The following presents the frameworks of different countries on the generic skills expectation from the engineering accreditation bodies and HE policies. The importance of knowing and having recognition of a set of generic skills globally has become more critical at the current time because of the international nature of employment (DEST, 2007; Zaharim et al., 2009; Yusoff et al., 2012). Covered below are country – framework; United States of America (USA) – Workplace Know-How and ABET Engineering Criteria; Australia – Engineering Competencies; Europe – EUR-ACE Framework Standards and Guidelines (EAFSG); and Malaysia – Engineering Employability Skills.

- **United States of America (USA) – Workplace Know-How and ABET Engineering Criteria**

ABET (2014) documented 11 engineering student outcomes to be articulated by the engineering programme. The outcomes focused on technical and generic skills as listed below:

a. An ability to apply knowledge of mathematics, science, and engineering.
b. An ability to design and conduct experiments, as well as to analyse and interpret data.
c. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
d. An ability to function on multi-disciplinary teams.
e. An ability to identify, formulate, and solve engineering problems.
f. An understanding of professional and ethical responsibility.
g. An ability to communicate effectively.
h. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
i. A recognition of the need for, and an ability to engage in lifelong learning.
j. A knowledge of contemporary issues.
k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (p. 3).

- **Australia – Engineering Competencies**

In Australia, many universities have addressed or are addressing, the importance of generic skills, which they refer to as employability skills, through their graduate attributes (Patil et al., 2008). Monash University, for example, redefined its overall set of graduate attributes to attain the programme educational objectives. Accordingly, Australian engineers are required to comply with Engineers Australia (EA) requirements. EA developed eight engineering competencies as described by DEST (2007, p. 10).

a. Communication skills – ability to communicate effectively, with the engineering team and with employees and customers.
b. Teamwork skills – ability to function effectively as an individual and in multi-disciplinary and multi-cultural teams, as a team leader or manager as well as an effective team member.
c. Problem-solving skills – ability to solve problem that contribute to productive outcomes.
d. Self-management skills – ability to manage information and documentation
e. Lifelong learning skills – capacity for lifelong learning and professional development.
f. Technology skills – ability to contribute to effective execution of tasks.
g. Planning and organising skills – ability to contribute to long-term and short-term strategic planning.
h. Initiative and enterprise skills – ability to contribute to innovative outcomes.

- **Europe – EUR-ACE Framework Standards and Guidelines (EAFSG)**

The European Network for Engineering Accreditation for Engineering Accreditation (ENAEE) is the European body responsible for awarding authorisation to accreditation agencies to award the EUR-ACE label and to engineering programmes which they have accredited (ENAEE, 2009). The EUR-ACE accreditation framework known as EUR-ACE Framework Standards and Guidelines (EAFSG), was developed in collaboration with EU Socrates and Tempus Programmes and by 14 European associations concerned with Engineering Education, in order to strengthen the competitiveness and attractiveness of European HE and to foster student mobility and employability (ENAEE, 2015). EAFSG described eight skills as well as programme learning outcomes in the learning process for the graduates to demonstrate, as presented in Table 2-2.

Table 2-2 EAFSG programme learning outcomes (ENAEE, 2015, pp. 5-7)

Skills	Programme Learning Outcome
1. Knowledge and Understanding	• Ability to analyse complex engineering products, processes and systems in their field of study; to select and apply relevant methods from established analytical, computational and experimental methods; to correctly interpret the outcomes of such analyses. • Ability to identify, formulate and solve engineering problems in their field of study; to select and apply relevant methods from established analytical, computational and experimental methods; to recognise the importance of non-technical – societal, health and safety, environmental, economic and industrial – constraints.
2. Engineering Analysis	• Ability to analyse complex engineering products, processes and systems in their field of study; to select and apply relevant methods from established analytical, computational and experimental methods; to correctly interpret the outcomes of such analyses. • Ability to identify, formulate and solve engineering problems in their field of study; to select and apply relevant methods from established analytical, computational and experimental methods; to recognise the importance of non-technical – societal, health and safety, environmental, economic and industrial – constraints.
3. Engineering Design	• Ability to develop and design complex products (devices, artefacts, etc.), processes and systems in their field of study to meet established requirements, that can include an awareness of non-technical – societal, health and safety, environmental, economic and industrial – considerations; to select and apply relevant design methodologies. • Ability to design using some awareness of the forefront of their engineering specialisation.
4. Investigations	• Ability to conduct searches of literature, to consult and to critically use scientific databases and other appropriate sources of information, to carry out simulation and analysis in order to pursue detailed investigations and research of technical issues in their field of study. • Ability to consult and apply codes of practice and safety regulations in their field of study. • Laboratory/workshop skills and ability to design and conduct experimental investigations, interpret data and draw conclusions in their field of study.
5. Engineering Practice	• Understanding of applicable techniques and methods of analysis, design and investigation and of their limitations in their field of study.

	• Practical skills for solving complex problems, realising complex engineering designs and conducting investigations in their field of study. • Understanding of applicable materials, equipment and tools, engineering technologies and processes, and of their limitations in their field of study; • Ability to apply norms of engineering practice in their field of study. • Awareness of non-technical – societal, health and safety, environmental, economic and industrial – implications of engineering practice. • Awareness of economic, organisational and managerial issues (such as project management, risk and change management) in the industrial and business context.
6. Making Judgements	• Ability to gather and interpret relevant data and handle complexity within their field of study, to inform judgements that include reflection on relevant social and ethical issues. • Ability to manage complex technical or professional activities or projects in their field of study, taking responsibility for decision-making.
7. Communication and Team Working	• Ability to communicate effectively information, ideas, problems and solutions with engineering community and society at large. • Ability to function effectively in a national and international context, as an individual and as a member of a team and to cooperate effectively with engineers and non-engineers.
8. Lifelong Learning	• Ability to recognise the need for and to engage in independent lifelong learning. • Ability to follow developments in science and technology.

- **Malaysia – Engineering Employability Skills**

The Ministry of Education Malaysia required their universities to enhance students' generic skills during HE as stated in the Malaysian Qualification Framework (MQF) 2011 (Ariffin et al., 2012). By aligning with other employability skills frameworks conducted overseas, as described above, Yusoff et al. (2012) made an attempt to propose the first employability skills framework in Malaysia called Malaysian Engineering Employability Skills (MEES) to guide future, new as well as experienced engineers to develop, sustain and improve their generic skills to allow them to become valuable employees in their companies. The proposal consists of ten skills as required by Malaysian EAC (2006), each with its five attributes as listed in Table 2-3.

Table 2-3 Element of sub-component of MEES (Yusoff et al., 2012, pp. 44-45)

Skills and EAC Programme Learning Outcome (PLO)	Attributes
1. Communication Skills Ability to present ideas with confidence and effectiveness through aural, oral and written modes, not only with engineers but also with the community at large.	• Speak in clear sentences. • Give clear directions. • Listen and ask question. • Present ideas confidently and effectively. • Understand and speak English and other languages.
2. Teamwork Ability to function effectively as an individual and in a group with the capacity to be a leader or manager as well as an effective member.	• Function effectively as an individual. • Understand role in a group. • Function effectively as a team member in a group. • Accept and provide feedback in constructive and considerate manner. (Forming, storming, performing, adjourning). • Work in a group with the capacity to be a leader.
3. Lifelong Learning Ability to recognise the need to undertake lifelong learning, and process/acquire the capacity to do so.	• Recognise the need to undertake lifelong learning. • Possess and acquire the capacity to undertake lifelong learning. • Engage in lifelong learning. • Set personal learning targets. • Plan in achieving learning goal(s).
4. Professionalism Ability to understand social, cultural, global and environmental responsibilities of a professional engineer, and have a commitment to professional and ethical responsibilities.	• Understand social responsibilities (human factors and social issues). • Understand cultural and global responsibilities (awareness of cultural and natural surroundings). • Understand environmental responsibilities (aware of environmental needs). • Commit to professional responsibilities (be professional as an engineer). • Commit to ethical responsibilities. (be accountable for actions).
5. Problem-Solving and Decision-Making Ability to undertake problem identification, apply problem-solving, formulations and solutions.	• Undertake problem identification (identify problems in work place). • Implement problem-solving (use experiences to solve problems). • Apply formulations and solutions (use science, mathematics or technology to solve problems). • Be creative, innovative and see different points of view

	• Identify the root cause of problems.
6. **Competency in Application and Practice** Ability to use the techniques, skills, and modern engineering tools.	• Use the necessary techniques for engineering practice. • Use the necessary skills for engineering practice. • Use modern engineering tools and software. • Work towards quality standards and specifications. • Assemble equipment following written directions.
7. **Knowledge in Science and Engineering Principles** Ability to acquire and apply knowledge of engineering fundamentals.	• Continue to acquire knowledge of sciences and engineering fundamentals. • Apply knowledge of engineering fundamentals. • Select and use proper tools and equipment for particular job/task. • Access, analyse and apply skills and knowledge of science and engineering. • Understand principles of sustainable design and development.
8. **Knowledge of Contemporary Issues** Ability to continue learning independently in the acquisition of new knowledge, skills and technologies.	• Continue learning independently in the acquisition of new knowledge, skills and technologies. • Use information technologies. (computers, networks and electronics) • Use communication technologies in the knowledge-based era. • Use computing technologies. • Read newspaper.
9. **Engineering System Approach** Ability to utilise a systems approach to design and evaluate operational performance.	• Utilise a system approach to design operational performance • Utilise a system approach to evaluate operational performance. • Design systematically • Analyse engineering design • Demonstrate a knowledge and understanding of engineering system for management and business practices.
10. **Competent in Specific Engineering Discipline** Ability to acquire in-depth technical competence in a specific engineering discipline, competent in theoretical and research engineering and perform basic entrepreneurial skills.	• Continue to acquire in-depth technical competency in a specific engineering discipline. (electrical, highway, structure etc.). • Apply technical skills in a specific engineering discipline effectively. • Design and conduct experiments. • Analyse and interpret data.

	• Apply knowledge in multi-disciplinary engineering.

2.2.1.2 From the Employers' Perspective

Most of the employers claimed generic skills shared equal importance with technical skills in terms of securing employment (Yunus et al., 2005). Besides basic education and technical skills, most employers required that graduates acquire non-technical and intangible skills (Saad et al., 2013). Employers are looking not only at graduates' competency in technical skills but also their generic skills (Callan, 2003; Rahman et al., 2011). Moalosi et al. (2012) suggested that it is important for HE to respond to demands from employers by setting pre-defined generic attributes and skills.

Graduates' generic skills attributes are critically important, because of the constant and challenging demands of most modern workplaces (Moalosi et al., 2012). Generic skills are used by employers to distinguish between graduates with the same educational background (Nilsson, 2010). However, many article in the literature revealed graduates' lack of generic skills have been acknowledged by the employers around the world as being particularly problematic (Zaharim et al., 2009; Saunders et al., 2010; Lowden et al., 2011; Shah et al., 2011; Mai, 2012; Saad et al., 2013).

The literature also provided evidences of employers' perceptions of engineering graduates with regards to generic skills. For example, research by Zaharim et al. (2009) made a comparison of the generic skills needed by engineering employers in Malaysia, Japan, Singapore and Hong Kong. Table 2-4 summarises the research findings.

Table 2-4 Engineering generic skills required by employers in Malaysia, Japan, Singapore and Hong Kong (Zaharim et al., 2009)

No.	Malaysia	Japan	Singapore	Hong Kong
1.	Effective communication	Communication skills	Workplace literacy and numeracy	Work attitude
2.	Competencies in application and practice	Problem-solving skills	Information and communications technology	Interpersonal skills
3.	Interpersonal or team working skills	Goal-setting skills	Problem-solving and decision-making	Analytical and problem-solving skills

4.	Engineering problem-solving and decision-making skills	Personal presentation skills	Initiative and enterprise	English language proficiency
5.	Apply knowledge of science and engineering principles	Visioning skills	Communication & relationship management	Numerical competency
6.	Competency in specific engineering discipline	IT and computer skills	Lifelong learning	Information technology literacy
7.	Understanding of professional, social and ethical responsibilities	Leadership skills	Global mind-set	Management skills
8.	Lifelong learning	Self-assessment skills	Self-management	Chinese language proficiency
9.	Engineering systems approach		Workplace-related life skills	
10.	Knowledge of contemporary issues		Health and workplace safety	

In their research, Saad et al. (2013) reported that generic skills are the skills required by employers, mostly as they need adaptable future employees who can easily learn, relearn and (in some cases) unlearn required knowledge over time (p. 43). Similarly, according to NCVER (2003), generic skills are important because the labour market environment today requires *"flexibility, initiative and the ability to undertake many different tasks",* including the need to use *"problem-solving, abilities to make decisions, taking responsibility and communicating effectively"* (p. 2).

The generic skills, frequently highlighted, that are lacked by graduates are: problem-solving skills, communication skills and team working skills, (Hagan, 2004; Yusof, 2010; Saad et al., 2013). These are the main skills identified by employers in the UK and a-broad as important for students to possess before they can deal effectively with the demands of the workplace (Blom et al., 2011; Mason et al., 2011; Yusoff et al., 2012). Research by Zaharim et al., (2009) came to the same conclusion that these were the skills that graduates most needed to develop (p. 199). Thus, the following sections will discuss generic skills further and then focus on these three skills in particular.

2.3 Generic Skills

Allan et al. (2007) suggested that academic staff provided more opportunities for the development of students' generic skills to prepare graduates for future employment. Shuman et al. (2005), delineated generic skills into two types: process-oriented (including communication skills, teamwork, and the ability to recognise and resolve ethical dilemmas) and awareness-oriented (including understanding the impact of global and social factors, knowledge of contemporary issues, and the ability to develop lifelong learning). This division was made with the aim of enabling best teaching and assessing.

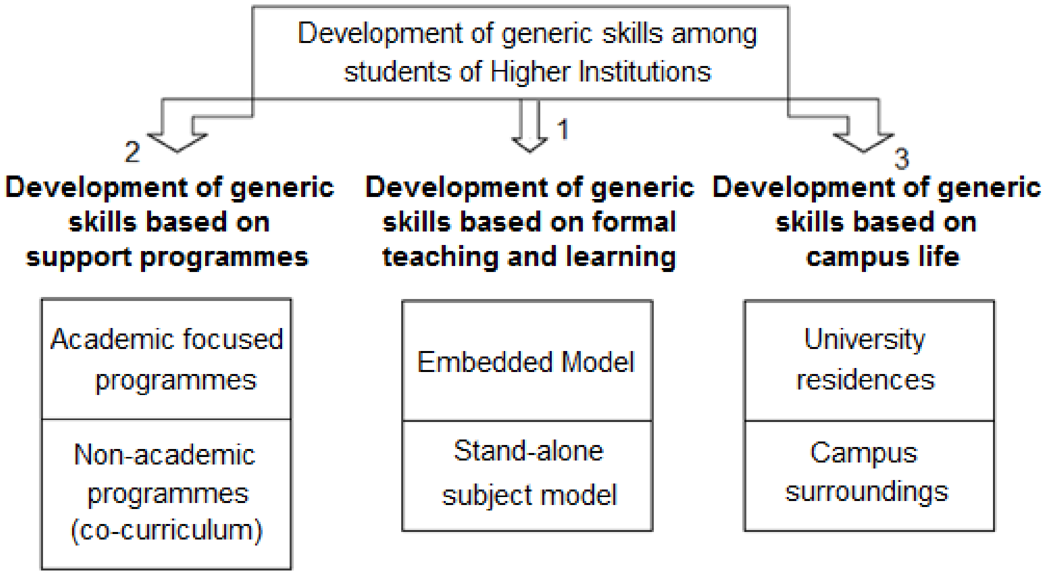

Figure 2-1 Model for implementation of generic skills in Malaysian Institute of Higher Learning (Ministry of Higher Education Malaysia, 2006, cited in Shakir, 2009)

Similarly, the Malaysian Institute of Higher Learning proposed a framework to be employed by HE institutions in Malaysia to implement generic skills, as shown in Figure 2-1. The framework suggested that generic skills were developed by students in HE institutions through three approaches: support programmes (academic and non-academic programmes), formal teaching and learning activities (embedded and stand-alone models) and from the experience of living in university environment (university residence and campus surroundings). Generic skills can easily be developed in HE when students are engaged in relevant experiences in contexts that students find meaningful for their learning (Crosthwaite et al., 2006). How generic skills are articulated in the HE environment makes a significant difference to students' learning, and to lecturers' teaching processes, and so affects the extent to which students develop the skills and achieve intended learning outcomes (Barrie, 2006). In order to make this paradigm shift, teaching processes in HE need a more comprehensive approach and to focus on the development of human potential as a whole (Rabl et al., 2012). Woods et al. (2000) suggested eight basic activities to promote generic skills development as listed below.

- Identify the skills that students need to develop, integrate them into the syllabus and highlight the importance of the skills.
- Use research to identify the target skills and share the outcomes with the students.
- Make explicit the implicit behaviour associated with successful application of the skills.
- Provide extensive practice in the application of the skills, use structured activities and provide constructive feedback.
- Encourage monitoring.
- Encourage reflection.
- Grade the process of acquiring the skills, not just the result.
- Use standard assessment and feedback (pp. 2-4).

The next section presents briefly the literature of each of the generic skills (problem-solving skills, communication skills and teamwork skills). Engineers need to be able to function as effective members of teams and have strong verbal communication and problem-solving skills (NAE, 2004). Each of the skills has a section on:

- The importance of the skill
- Definition of the skill
- Skill development

2.3.1 Problem-Solving Skills

Jonassen (2011) claimed that the central focus of learning and instruction should be happening during the process of solving a problem. His arguments are that, while solving problems, knowledge is constructed, is more meaningful, more integrated, better retained and more transferable. Problem-solving is a process and a skill that a person develops over time, to be used when needing to solve a problem. Most educators would agree that the engineers' main task is to solve problems. However, there is disagreement as to how engineers are educated to be good problem-solvers (Northwood et al., 2003).

2.3.1.1 The Importance of Problem-Solving Skills

Learning to take a problem-solving approach has become important in engineering. Engineers have needed to develop mindsets that could be described as "powerful analytical tools" in order to elicit the most possible solutions to a variety of problems (El-Zein et al., 2016). The world's economy has become increasingly interlinked and the importance of collaboration involving international teams has increased concurrently. Additionally, growing complexities of different scenarios demand that engineers acquire new knowledge simultaneously to solve engineering problems (Rabl et al., 2012). Jonassen et al. (2006) found that engineers in industry solve problems that:

- Combine well-structured problems and complex ill-structured problems.
- Measure success by non-engineering standards.
- Consider non-engineering limitation.
- Require extensive collaboration with other engineers and non-engineers.
- Always encounter unanticipated problems.
- Primarily rely on experiential knowledge.

The Faculty of Engineering and Surveying in University of Southern Queensland is an example of an HE Institute that recognises the importance of problem-solving skills. It has grounded the faculty philosophy that engineers should be predominantly problem-solvers, able to utilise the latest technology to solve multi-disciplinary problems throughout their professional lives (Gibbings et al., 2007).

2.3.1.2 Definition of Problem-Solving Skills

The literature suggested the adoption of a broader paradigm of definitions for problem and problem-solving, as well as for decision-making (Downey, 2005; El-Zein et al., 2008). The US National Academy of Engineering, NAE (2004) described problem-solving skills as the ability to frame problems, putting them in a socio-technical and operational context. Problem-solving involves a cognitive role in processing information where people need to think with the prior knowledge that they have (Krishnan et al., 2009). The US National Academy of Engineering, NAE (2011) conducted an online research of 3,600 people to study the public perception towards engineering. One of the messages that emerged from the research was that "engineers are creative problem-solvers". Correspondingly, El-Zein et al. (2016) described problem-solving as a defining feature of engineering identity. The ability to solve problems is built into the engineering curricula in HE as a learning outcome and a graduate attribute (p. 692).

2.3.1.3 Problem-Solving Skills Development and Its Challenges

Real engineering problems in industry are substantively different from the problems that engineering students are exposed to in the classroom (Jonassen et al., 2006). Jonassen (2011) argued that engineering students are taught mostly to solve only textbook problems; therefore, learning to solve classroom problems does not necessarily develop students' problem-solving skills. The author claimed that students should learn to solve problems by: reconciling multiple conflicting constraints and criteria; being aware of multiple sub-problems; communicating and negotiating with both engineers and non-engineers; and anticipating problems. Woods et al. (2000) suggested three activities that students can use to develop problem-solving skills more efficiently. These are to: use standard research-based problem-solving strategies across several courses in an instructional programme, consider providing some in-depth problems to be solved and to help students integrate the problem statement, the identification of required technical knowledge, and possible problem solutions.

Teaching the problem-solving process in the classroom can be achieved in a number of ways. Thinking Aloud in Pairs Problem-Solving (TAPPS), where problem-solving processes are developed through interaction between the problem-solver and a listener, is particularly useful (Biggs, 1999b). Instructional design and learning design theories also can be considered as another method in problem-solving development as the instructional methods and models are used in a given situation or context (Gunasekara, 2004). Another well-recognised method for developing problem-solving skills is the use of PBL exercises or activities (Nair et al., 2009). Decision-making is usually incorporated with problem-solving (El-Zein et al., 2008). In addition, questioning and answering deep-reasoning questions also help to develop problem-solving skills by articulating causal process as well as goals, plans, actions, and logical justification (Jonassen, 2011).

While all the activities described above are aimed at helping students develop problem-solving skills, Downey (2005) argued that Engineering Education should go beyond problem-solving into problem definition and solving, which the author called as PDS. Downey claimed PDS could benefit engineering students to engage with the process of developing these skills. Indeed a shift to PDS, if it benefits students acquiring these skills, benefits all, and the public good is served (El-Zein et al., 2016). According to Downey (2005), PDS requires collaboration with the problem's stakeholders, includes non-technical aspects of the problem and promotes leadership practice.

The challenges of developing problem-solving skills have been discussed in the literature. Several authors claimed that HE hinders future engineers from moving outside of the technical box, which decreases their ability to solve ill-structured problems (Jonassen et al., 2006). Problem-solving frequently relates to mathematical abstraction and reductionism while overlooking social and political complexity (El-Zein et al., 2016). Similarly, Giddens (2009) described technologies as always being embedded in political, economic and social frameworks, which are likely to govern both how they develop and the resulting consequences (p. 187). If Engineering Education programmes want to resolve the above challenges, they must grasp the nature of problem-solving in the workplace.

2.3.2 Communication Skills

Communication involves receiving as well as transferring information. It has been stated by Kline (1996) that people spend 70% of their waking hours taking part in some form of communication activity, with that time split into the following proportions:

- 10% writing
- 15% reading
- 30% talking
- 45% listening (p. 2)

Communication skills, such as reading/visual, listening, oral and written skills, are essential components in the education of engineering students for preparing them for their careers in the future (Riemer, 2007). Schuurman et al. (2007) claimed that there are many reports from educators and employers indicating that engineering graduates have poor communication skills and added that many engineering programmes have tried various ways of incorporating communication skills in their curricula (p. 2). Roulston et al. (1992) and Riemer (2007) identified four sources of weakness which contributed to bad communication skills:

- Students' attitudes and willingness to communicate.
- Insufficient course content.
- Deficient or inappropriate teaching methods.
- Lack of opportunity for engineering students to practise communication skills.

While Trilling et al. (2009) listed criteria for establishing good communication skills as:

- Articulating thoughts and ideas effectively, using oral, written and nonverbal communication skills in a variety of forms and contexts.
- Listening effectively to interpret meaning, including knowledge, values, attitudes and intentions.
- Using communication for a range of purposes such as to inform, instruct, motivate and persuade.
- Utilising available multimedia and technologies.
- Communicating effectively in diverse environments, including multilingual surroundings (p. 55).

There are various elements of communication skills. Thus, the next section will provide a review of the literature regarding written, visual and listening communication, before the thesis focuses its discussion on verbal communication.

- **Written communication**

Written skills can lead to the establishment of other skills. As such Larkin-Hein (2000) found that writing can enhance problem-solving skills, as well as be directed to critical thinking aptitude (p. 15). According to Preiss et al. (2013), individual differences in verbal communication are an expression of underlying differences in writing ability. The quality of written communication needs to be benchmarked, as it should generate feedback and provide an accurate assessment of standard, as well as make a positive impact on student learning (Riemer, 2007). Examples of written activities and assessments include: engineering reports, writing assignments, reflective journals, reflection accounts, peer reviews and student conferences.

- **Visual Communication**

Visual communication is the ability to perceive image-based information, (then processing and understand it) and have the skills to communicate this to others through the medium of drawing and the use of software in modelling and programming (Jervis et al., 2005). Instead of reading words, it is clear that every engineering professional also relies heavily on the use of visual forms of non-verbal communication (Riemer, 2007). This can also facilitate communication between people of different linguistic, ethnic and cultural backgrounds or be a major factor of success within multi-disciplinary approaches (Lappalainen, 2010). The activities for visual communication include programming, drawing and understanding engineering diagrams, films, pictures, and graphs.

- **Listening Communication**

Kline (1996) defined listening as *“The process of receiving, attending, and understanding auditory messages; that is, messages transmitted through the medium of sound”* (p. 15). Listening skills are just as important as oral and written skills. Listening entails the reception and correct understanding of verbal communication (Riemer, 2007). Inconsistencies in listening skills can cause auditory messages to be ignored, distorted and misinterpreted. Listening skills activities include: interviews, active discussions, peer reviews and individual feedback.

2.3.2.1 The Importance of Verbal Communication Skills

In engineering, knowledge and technical know-how are critically important; however, these must be presented using outstanding communication skills, particularly oral skills (Riemer, 2007; Lappalainen, 2010; Radzuan et al., 2010). Engineering work is conducted verbally – communicating interpersonally, in small groups and larger teams - almost daily (Darling et al., 2003). Above all, oral skills represent the most important skill demanded by employers. According to a study conducted by the UNESCO International Centre for Engineering Education (UICEE), employers are seeking graduates with strong verbal communication and students are increasingly aware of the importance of these skills (Talbot et al., 2013). It is also acknowledged by Kassim et al. (2010) that fluency in the English language is seen as an opportunity, within the engineering field, to advance towards becoming a truly global engineer (p. 168). With the number of international engineering projects increasing, the requirement for cross-cultural communication and collaboration rises (Riemer, 2007; Rabl et al., 2012) and so oral communication skills become ever more important (Lappalainen, 2010; Radzuan et al., 2010; May et al., 2011). The needs for accountability will necessitate students having the ability to communicate convincingly and to justify their opinions to other engineers and the community (NAE, 2004).

2.3.2.2 Definition of Verbal Communication Skills

According to Williams (2002), verbal communication skills is: *"The ability to give effective oral presentations, specifically informal presentations to peers, team members, and immediate supervisors that are typical of engineers working in industrial settings"* (p.205). Afflerbach et al. (2008) described oral communication as a process of transferring information directly or indirectly via verbal communication. The US National Education Association, NEA (2015) briefly defined verbal communication skills as follows:

- Articulating thoughts and ideas effectively using oral communication skills in a variety forms and contexts.
- Listening effectively to decipher meaning, including knowledge, values, attitudes, and intention.
- Using verbal communication for a range of purposes.
- Utilising multimedia and technologies, knowing how to assess impact and their effectiveness a priori.
- Communicating effectively in diverse environments (p. 14).

In their research Abdulwahed et al. (2013) proposed a definition of verbal communication skills as the *"ability to communicate effectively verbally with all stakeholders (public, engineers, …) across all boundaries (cultural, language, …)"* (p. 760).

2.3.2.3 Verbal Communication Skills Development and Its Challenges

Verbal skills in the framework of the Council of Europe, COE (2001) is divided into three parts, namely listening skills, speech production skills and spoken interaction skills. The COE emphasised two main aspects in teaching oral proficiency: fluency and accuracy of speech. Later other aspects were also stressed, such as phonology, pronunciation, stress and intonation (Rahman, 2012). Rahman described the word "fluency" as being smooth and good communication in the spoken language, while "accuracy" is based on using the appropriate rules of grammar and good vocabulary selection.

Schuurman et al. (2007) in their research on 'employers' input on communication skills found the following are core to oral communication: content-development skills; presentation skills; receptive skills; and audience-analysis skills (p. 2). Activities that involve oral communication include: seminar and small-group discussion, mock interviews, debates, role plays, group and individual presentations, and dissertations (Riemer, 2007). However, Darling et al. (2003) argued that formal presentations are not as typical for practising engineers as informal communication events, but they are nevertheless vitally important.

Jonassen et al. (2006) recommended that HE institutions added more verbal communication skills to the curricula. The authors' study of everyday engineering problems found that engineers needed more instruction on client interaction, intensive collaboration involving internal or external personnel, making oral presentations as well as gaining the ability to deal with ambiguity and complexity (p. 146).

Dannels et al. (2003) identified the challenges in learning verbal communication skills in Chemical Engineering. Among the challenges acknowledged in the study are those listed below:

- Students struggling with the complex process of negotiating disciplinary knowledge (design work) with the social context (teamwork, speaking with an audience, etc.).
- Students viewing speaking content as a distraction from their real work design.
- Lecturers finding it challenging to integrate multi-disciplinary information and for students to accept this knowledge.
- Students being resistant to speaking (pp. 54-55).

2.3.3 Teamwork Skills

In this thesis, the terms "group" and "team" are used synonymously. Matthews (2002) stated that teaching and learning in small groups serves two educational purposes: the development of social learning and the growth of interpersonal skills; this includes reasoning, problem-solving, and leadership (p. 1). Teamwork skills are developed when students are expected to solve complex tasks by themselves (Kolmos et al., 2007).

2.3.3.1 The Importance of Teamwork Skills

Teamwork skills are necessary to complete task successfully together with other group members. These skills are highly valued, not only from the perspective of employers but also from the paradigm of the educational sector (Flynn et al., 2004; MQF, 2011). According to Turner (2001), group work is recognised as a viable method of enhancing human performance in industrial and educational settings. Teamwork often used in contexts that require active methodologies can be significant to learning (Marin-Garcia et al., 2008). Many researchers identified the positive impact of teamwork on students' academic performance, motivation and better attitudes in their learning (Frank et al., 2004; Kennedy, 2005; Kalliath et al., 2006).

2.3.3.2 Definition of Teamwork Skills

"Teams" have come to be considered as a central element in the functioning of organisations (Cooperstein et al., 2004). In short, teamwork skills are defined as working effectively in teams (Palmer et al., 2011). Marin-Garcia et al. (2008) briefly defined teamwork as: *"A small number of interdependent persons with complementary skills, who interact in order to acquire knowledge, skills or attitudes and produce joint results"* (pg.1790). However, Patil et al. (2008) described teamwork to be when a person has the ability to perform activities which require the capacity for co-operation. Teamwork often requires people to be work with others from diverse backgrounds - to achieve the same objective. In a similar vein, Rabl et al. (2012) elaborated the teamwork definition as people working together from different countries/globally coming from multi-disciplinary backgrounds. Abdulwahed et al. (2013) expanded the definition to consider also the multicultural aspect of teamwork.

2.3.3.3 Teamwork Skills Development and Its Challenges

Teamwork can easily be developed through students' team projects in the classroom (Shuman et al., 2005). The development of these skills is more effective if students experience authentic design and implemented projects, where students work on real problems in industry for actual clients (Last, 2003). Examples of team working activities and assessments include: group presentations, discussions, peer- and self-review, assignments, and peer-assisted learning (Willcoxson, 2006). Peer-assisted learning (mentoring/learning within teams) can help to motivate students' learning and to enhance team spirit (Frank et al., 2004), so this activity should be encouraged, recognised and rewarded by academic staff (Gibbings et al., 2007). Savin-Baden (2004) described both mentoring between team members and feedback by peers as being important parts of learning and strong motivators for students to work in teams.

Marin-Garcia et al. (2008) and Bacon et al. (1999) claimed that teamwork is composed of two parts:

- **Product –** what the team should hand in or submit (such as reports, assignment, oral presentations).
- **Process –** the way in which team members carry out the tasks (such as activities and behaviour patterns of each team members).

The assessment of process is usually incorporated with the objectives of the course, such as "to experience", "to have the opportunity" or "to work effectively in a group" (Kennedy, 2005). Similarly, Gibbings et al. (2007) listed a comprehensive list of teamwork learning objectives to assist students to understand what is expected of them with regards to these skills. The corresponding learning objectives are: to identify necessary leadership; lead the team effectively; analyse the dynamic of the team; negotiate within and outside the team; seek and evaluate team members' contributions; utilise knowledge and experience from team members from diverse backgrounds; and be aware of other team members' responsibilities (p. 6).

Comer (1995) suggested a way to structure the team by keeping teams as small as possible because:

- Team performance may decline because of the difficulty to manage larger numbers of people.
- Individual motivation may decline if individuals feel their contribution is not identifiable.
- Disagreement among the team members increases with team size (Gentry, 1980).

Research by Gibbings et al. (2007) on assessment strategy for an engineering problem-solving course identified challenges faced by the students and academic staff during the development of teamwork skills. Some team members may want to do all the tasks themselves without help from others. This commonly happens with "high achievers" who do not want others to help and affect their own marks. As the assessment marks the team rather than the individual, some students may not contribute very much to the team effort (Acar, 2004). Flynn et al. (2004) described this type of student as a "passenger", while Kalliath et al. (2006) and Willcoxson (2006) called them a "parasite or opportunist".

2.4 Generic Skills Assessment within Engineering Education

It is a demand from education policy makers and accreditation organisations for assessment to be part of the HE institution accountability process to ensure faculties at institutions perform as they are expected. These two processes of assessment and accountability are often collectively referred to as assessment (Morreale et al., 2011). In reality, they are two different processes but are possibly embedded in each other. Frye (2006) simply described assessment as when the assessor assesses his/her own performance or the students; while accountability is when others assess the performance of the individual, the department, programme or institution. Faculties must develop assessment of students' learning, by; setting the student-focused learning objective, selecting appropriate method for the assessment, collecting, analysing, and interpreting the data for course and program improvement (Morreale et al., 2011).

Before further explaining the generic skills assessment approach, it is worth understanding the purposes of such assessments. Cummings (1998) described three stakeholder groups with interests in generic skills assessment: students – who want evidence for themselves and their lifelong learning agenda; employers – who want to know that students have attained employability skills; and the teaching institutions – which want to be able to defend their claims of producing graduates with certain skill sets.

The focus of the objectives of Engineering Education has evolved from knowledge to skills development as the consequence of the changing demands of employers of engineering graduates (Rompelman, 2000). This paradigm shift has also changed the views on assessment of student learning. Biggs (1999a) stated that the important feature of an education system designed to emulate current professional practice is that the crucial assessments within it should be performance-based, and holistic, allowing flexibility for students to make their own learnings. Furthermore, assessment methods should be aligned with the intended learning outcomes and consistent with the learning and teaching activities (Gibbings et al., 2007).

Generic skills assessment in engineering is a major challenge within an AL environment (for example, see Nopiah et al., 2009; Cajander et al., 2011). Clayton et al. (2003) suggested that amongst the critical factors impacting the quality of assessment within the learning and teaching environment are: invalid judgement by peers and lecturers; assessments that are not ill-defined; assessment inconsistencies; generic skills awareness; quality assurance; and the role of key players to sustain the assessment. In another case, Feldt et al. (2009) conducted a survey of 23 students undertaking Master thesis projects in Software Engineering on their generic skills performance. The outcome of the survey found that the intended generic skills were not in line with the expectation of the supervisor. The main issue identified by Feldt is that students do not understand what generic skills are.

With regards to the assessment of students' generic skills performance, Ariffin et al. (2012) highlighted the importance of identifying whether students have achieved a satisfactory level at the point of entry to the institute. The authors further suggested implementing an orderly and systematic intervention programme for students who acquire minimum levels of generic skills. Other studies have also found the issue of assessment to be relevant (Biggs, 1999a; Murphy, 2001; Allan et al., 2007). If any revision were to be made to the assessment of generic skills, Gibbings et al. (2007) suggested there should be more emphasis placed on the development of the skills, and how new skills are learnt, rather than just achieving the minimum standard.

Any assessment within an AL environment requires much care and consideration. Generic skills assessment must embody a non-traditional approach of assessment (Gibbings et al., 2007). If lecturers retain the assessment methods they use in their traditional curriculum approaches, the outcome can be a misalignment between their objectives and the student learning outcomes (Mcdonald, 2005; Biggs et al., 2010). One of the approaches used to ensure and assess the alignment of assessment methods with the learning outcomes is Constructive Alignment (Biggs, 1996). It is a well-defined and broadly accepted approach in Engineering Education (for example, see Duffy et al., 2010; Broman et al., 2012; Cain et al., 2012).

2.4.1 Generic Skills Assessment Methods

Various definitions and methods have been used to ease the generic assessment skills process (Yusoff et al., 2012). Silva (2009) claimed that generic skills can be measured accurately and in a common and comparable way. The problem of generic skills assessment is whether the observations of the students' progress and performance can be carried out in a credible and trustworthy manner (Jonsson et al., 2007). No matter how data is presented, there is always the issue of interpretation, although it is helpful to look at the statistical measures (Prince, 2004). Stemler (2004) stated that the accuracy and consistencies of the assessment can be determined through three main approaches: consensus estimates – determining the degree to which different assessors give the same score to the same performance; consistency estimates – determining the correlation of scores among assessors; and measurement estimates – determining, for instance, the degree to which scores can be attributed to common scoring. Current Engineering Education literature suggested generic skills are assessed through several methods as described below.

- **Self- and Peer Evaluation**

  Yasin et al. (2009) suggested that courses or programmes within an AL environment should employ continuous and alternative assessment besides the traditional assessment; for example, process evaluation, peer evaluation and self-evaluation. It is advantageous for students' learning to be involved in giving and receiving feedback (Jonsson et al., 2007). Kennedy (2005) described peer assessment as *"any of a variety of approaches where group members are required to evaluate other members of the group on their relative contribution to a project"* (p. 2). Peer assessments use typical peer rating systems, where student team members confidentially rate how well they and individual team members are doing in fulfilling their tasks or rate individual behaviours (Shuman et al., 2005). The approach contributes individual multiplier towards the team performance (Wellington et al., 2002). Peer assessment and self-assessment requires students to reflect and evaluate their own participation, learning progress, and the results of autonomous learning (Hart, 1994). Both self- and peer-assessment are expected to decrease the central role of the lecturer in assessment activities (De-Grez et al., 2012).

However, regarding both, peer and self-evaluation, on the one hand students can be very accurate in grading their own work; but, on the other hand, students tend to give more marks than teachers (Topping, 2003; Jonsson et al., 2007; De-Grez et al., 2012). Kennedy (2005) research pointed out the challenges when adopting peer assessment: students may be reluctant to judge peers; students may discriminate; dysfunctional effects of peer assessment; and students' different perceptions of fairness (pp. 62-64). Other challenges in self- and peer assessment include students being concerned about their inexperience in marking and the amount of time consumed through the activity (De-Grez et al., 2012). Regardless, many researchers and educators have adopted peer and self-assessment in assessing students' generic skills especially for teamwork skills (for example, see Brooks et al., 2003; Kennedy, 2005; Marin-Garcia et al., 2008; Kim, 2013; Mohd-Yusof et al., 2013)

- **Formative and Summative Assessment**

Several studies have shown that feedback can be an effective strategy that promotes active learning (Nicol et al., 2006; Biggs et al., 2007; Oliveira et al., 2013). According to Biggs et al. (2007), there are two types of assessment, summative and formative. Summative assessment is usually made after learning and informs students whether or not their learning corresponds to what is expected. Formative assessment is made during the learning process and informs students (and teachers) on how it is progressing and what actions should be taken to improve it. For this formative feedback to be effective, it is necessary that students are aware of what they have learnt, what they need still to learn and know what is expected of them (Biggs et al., 2007; Oliveira et al., 2013). Nicol et al. (2006) suggested that feedback should give the necessary information for students to minimise this difference. Knight (2001) summarised the key concepts related to summative and formative assessment as shown in Table 2-5.

Table 2-5 Summative and formative assessment (Knight, 2001, p. 9)

Dimension of difference	Summative – assessment as measurement	Formative – assessment as judgement
Assumptions about achievement	Achievements are seen as transferable. Data can be used to predict achievement.	A limited transfer of learning. Data cannot be used as a good predictor.
Products	"Feedout" in the shape of warrants to achievement	Feedback in the shape of improvement
Priorities	• Reliable measures of achievement. • Motivating learners.	• Providing feedback that allows

	• Providing information to guide learning.	opportunities to improve learning. • Motivating learners.
How assessments are communicated	Often in numerical form.	Often in words - narrative.
Common assessment techniques	Fixed response test.	High-inference judgements of authentic achievements on projects, work placements, peer and self-assessment.
Suggestions for improvement	• Use programme-wide assessment plans to identify what is going to be assessed and when. • Develop the assessment criteria. • Ensure that there are repeated observations of ILO's that are summatively assessed. • Use multiple observers/assessors.	• Use learning indicators as points of reference in assessment conversation. • Allow enough time - to design the assessment plan. • Provide awareness of how to do formative assessment (peer and self-assessment). • Link formative assessment with employability requirement.

- **Rubric Assessment**

A common practice in AL assessment is the rubric that is used in evaluating student generic skills performance in the Department of Aerospace at the United States Naval Academy (USNA) via the CDIO syllabus (Boden et al., 2007) and assessed ABET professional skills (Shuman et al., 2005; Kranov et al., 2008). Jonsson et al. (2007) listed several benefits of the rubric widely stated in the literature. These include: to increase or enhance consistency of judgement, to provide valid judgment, and to provide the desired validity in assessing complex generic skills. The rubric structurally tells both assessor and student what is considered important and what to look for when assessing (Perlman, 2003). A rubric articulates gradation of quality for each criterion it contains, from excellent to poor (Morreale et al., 2011).

When utilising the rubric, assessors use an analytic rating system where each component is scored individually or performance is rated holistically based on an overall impression (Pomplun et al., 1998). Jonsson et al. (2007) briefly distinguished two main categories of rubrics, analytic scoring and holistic scoring, as summarised in Table 2-6.

Table 2-6 Analytic and holistic scoring in rubric assessment (Jonsson et al., 2007)

Analytic Scoring	Holistic Scoring
Assessor assigns a score to each of the dimensions assessed in the task.	Assessor makes overall judgment on quality performance.
Useful in small-scale such as classroom.	Used for large-scale assessment.

The problem in rubric assessment is that many lecturers have an instinctive grasp of what generic skills are, but struggle to provide a clear definition of them and to define rubrics for their assessment (Cajander et al., 2011). Feldt et al. (2009) claimed that the rubric form should help assessors in the approach to the definition, clarification and assessment of generic skills performance. However, Jonsson et al. (2007) argued rubrics do not facilitate a valid judgement for performance assessment unless a more comprehensive framework of validity is used. Many educators and researchers in the literature utilised a rubric assessment to assess generic skills (Williams, 2002; Dunbar et al., 2006; Boden et al., 2007; Feldt et al., 2009).

- **Standardised Assessment**

The literature shows general agreement among HE institutions, accreditation organisations and employers that it is important for students to develop generic skills in order to secure employment (DEST, 2006; Yorke, 2006; Zaharim et al., 2009; Yusoff et al., 2012). A number of researchers conducted a study to define a set of generic skills. The outcome of the study contributed to a number of national frameworks of generic skills proposed in Malaysia, Australia, Japan, the United States of America, the United Kingdom as well as in the European Union (DEST, 2006; Yusoff et al., 2012; ABET, 2014). In the same respect, Singh et al. (2014) listed several countries which have a centralised and standardised generic skills assessment tool in place, for example, Australia – Graduate Skills Assessment known as GSA, England – Cambridge Thinking Skills Assessment and America – Work Keys System. Similarly, there is a centralised generic skills assessment conducted in America called the Collegiate Learning Assessment (CLA) (Klein et al., 2007). These countries, identified in the literature, have developed frameworks and/or guidelines for HE institutions to define clearly, observe and articulate graduate attributes in their curricula. However, each approach of the generic skills assessment as listed above has its advantages and drawbacks.

- **Reflective Report/ Portfolios**

Assessing the students' generic skills in an AL environment demands a careful consideration of various assessment techniques, where both the content and the assessment should be authentic (Hosseinzadeh et al., 2012). Authentic assessments are categorised into performance assessment and portfolio assessment (Tai et al., 2007). Regarding portfolio assessments, the literature often refers to the following definition provided by the Northwest Evaluation Association (NWEA): *"A portfolio is a purposeful collection of student work that exhibits the student's efforts, progress, and achievements in one or more areas. The collection must include student's participation in selecting contents, the criteria of selection, the criteria for judging merit, and evidence of student self-reflection."* (NWEA, 1990, cited from Barrett, 2000, p. 14; Williams, 2002, p. 201).

Gibbings et al. (2007) encouraged teachers to prepare guidelines to the students on the requirements of an individual portfolio. The portfolio is to create documentary evidence of what has been learnt and how skills and competence levels have increased. Reflective reports or portfolios are to be used during generic skills assessment and also encourage students to reflect on their learning during group work (Wellington et al., 2002). Portfolio assessment allows the assessor to assess students' progress in developing intended skills over a period of time, sometimes across several years (Barrett, 2000). The approach has also been widely used by many engineering accreditation bodies as offering an acceptable measure of students' attributes (S. Palmer et al., 2011). Portfolio assessment includes notes, commentaries and articles the students have read, and discussions of the evolution of their ideas to formulate and report their findings and conclusions (Tai et al., 2007; Hosseinzadeh et al., 2012).

Reflective reports or portfolio practices provide an opportunity for students to reflect his/her own writing practice, provide evidence of his/her progress in writing over time, and becomes a showcase of his/her work (Williams, 2002, p. 201). However, Cajander et al. (2011) argued that students are not likely to reflect on the development of generic skills unless required to do so, and that students are not likely to incorporate reflection as part of their on-going professional practice. Dannels et al. (2003) identified another reason for students not to complete reflective reports: they thought the reflections were part of the writing and speaking assignment which not contribute to any marks.

2.4.2 Current Approaches in Assessing Problem-Solving Skills and their Challenges

Whilst it may look easy to develop problem-solving skills, Morley et al. (2007) identified four questions surrounding problem-solving learning that need to be considered when designing assessments:

- What kind of problems do students learn to solve?
- What kind of problems should students learn to solve?
- What are the components of a learning environment?
- What are the cognitive scaffolds to support problem-solving?

According to Prince et al. (2006), systematic problem-solving assessment includes criteria such as understanding the problem with prior knowledge, generating and evaluating alternative solutions, progressing towards a solution, extracting general principles from specific solutions and making sense of new information (p. 6). Acar (2004) added that finding the information, practical work, reports and presentation are also among the assessment criteria for problem-solving skills. However, De Graaff et al. (2003) argued that problem-solving assessment should consist of establishing students' knowledge, skills and competencies rather than testing factual knowledge.

Sim et al. (2006) employed a summative assessment to assess students' reasoning skills and information-gathering. During the assessment, a 5-point Likert scale was used, where the tutor was required to rate each student's performance. In another case, Tai et al. (2007) used self-reflection and peer assessment to track the problem-solving process. In a way, the approach provided the students' a response to the ways problem-solving skills supported their learning process.

Another approach in assessing problem-solving skills is Model-Eliciting Activities (MEAs). MEAs were originally developed by mathematics educators and they were first introduced to engineering students at Purdue University (Diefes-Dux et al., 2004). According to Yildirim et al. (2010), MEAs are used as assessment tools to help analyse students' problem-solving processes. The assessment focuses on eight criteria namely problem identification, problem formulation, data gathering, modelling, experimentation, interpreting results, documentation and reflecting/reviewing the task. All the eight criteria are bounded by a certain duration of time.

Biggs et al. (2007) described problem-solving assessment as: being performance-based, holistic, and allowing plenty of scope for students to reflect on their own decisions and solutions. With respect to assessment reliability, Sim et al. (2006) expressed concern about the amount of consistency in assessment and the lecturers' judgement of students' skills performance.

2.4.3 Current Approaches in Assessing Verbal Communication Skills and their Challenges

Afflerbach et al. (2008) described verbal communication assessment as the process of assessing a person's verbal presentation style and their ability to support their arguments and opinions effectively through the use of verbal communication (p. 1). Morreale et al. (2011) reviewed 558 citations involving assessment of verbal communication from 1975 to 2009. The outcome of the research revealed that most of the literatures assessed verbal communication skills based on media literacy, service learning, and speaking and listening skills. Less than 5% focused on students' cognitive skills (p. 268). In another research, De-Grez et al. (2012) assessed verbal presentation in the following criteria: content-related criteria (quality of introduction, structure and conclusion); nature of delivery (eye contact, vocal delivery, enthusiasm, interaction with audience and body language); and general quality criterion (professionalism) (p. 133).

According to Williams (2002), faculties need to share a sense of how they want their students to develop verbal communication skills and develop assessment rubrics to provide comparable benchmarks by which faculties can judge the progress of their students (p. 205). Morreale et al. (2011) suggested different assessment strategies such as surveys, interviews, focus groups, capstone courses and portfolios, can be employed by the assessor/lecturer. Verbal presentation is another task considered in assessment (De-Grez et al., 2012). Dunbar et al. (2006) described the assessment of verbal communication skills across the entire programme as criterion-referenced evaluation based on standards set by the discipline or department as appropriate – for example, a performance-based evaluation rubric to assess students' verbal communication skills.

The appropriateness and effectiveness of verbal communication education is generally based on the situation and in the perceptions of the assessor (Morreale et al., 2011). As a result, the assessor depends on criteria that are often culturally bound, thus making the assessment more difficult compared to assessment in academic subjects. When referring to verbal communication skills assessment using self- and peer assessment, research by De-Grez et al. (2012) revealed that peers and lecturers - interpret the criteria and indicators of the rubric in a different way and self-assessment scores were higher than the marks given by the lecturer, in most of the part. However, Magin et al. (2001) suggested the reliability of summative assessments of verbal presentations can be improved by combining the lecturer marks with the average mark obtained from multiple peer ratings.

2.4.4 Current Approaches in Assessing Teamwork Skills and their Challenges

Students performance is influenced by elements such as marks for work that impact the final course grade (Porter et al., 2003). If the percentage of course grade associated with teamwork is set low, students may neglect any intended outcomes altogether (Ingham et al., 1974). In this respect, Koppenhaver et al. (2003) suggested the weight of importance given to team activities should be significant and peer evaluations should be used and graded (p. 16). Furthermore, if teams are assigned members with a range of capabilities and personal styles, a change of a single individual should not affect the overall team performance.

Many researchers considered self-assessment and peer assessment when assessing students' teamwork skills (Brooks et al., 2003; Marin-Garcia et al., 2008). The approach has been successfully used in the past by emphasising individual performance within groups by multiplying the team mark by an individual multiplier (Wellington et al., 2002). Another assessment used is a survey in which students assess aspects of teamwork by the rest of the students on his/her team, such as effort, contribution to project, critical ability, leadership, capacity for dialogue and appreciation of the different roles (Lacuesta et al., 2009).

Table 2-7 summarises the criteria for assessing teamwork skills according to different researchers.

Table 2-7 Researchers' criteria for assessing teamwork skills (Source: author)

Authors	Criteria
(Bacon et al., 1999; Brooks et al., 2003; Sheppard et al., 2004; Gibbings et al., 2007)	Number of participations during the group work and attendance during meetings.
(Brooks et al., 2003; Sheppard et al., 2004; Gibbings et al., 2007; Mohd-Yusof et al., 2013)	Appropriate interpersonal communication (listening to the ideas given by others, sharing ideas, valuing others' opinions, providing constructive feedback, having positive attitude).
(Tariq et al., 1998; Bacon et al., 1999; Brooks et al., 2003; Sheppard et al., 2004; Mohd-Yusof et al., 2013)	Gathering and preparing information prior to the meeting before its deadline.
(Tariq et al., 1998; Brooks et al., 2003; Gibbings et al.,	Quality of participation, peer teaching or of documents presented.

2007; Mohd-Yusof et al., 2013)	
(Bacon et al., 1999; Brooks et al., 2003)	Accepting and being aware of own and others' tasks.
(Sheppard et al., 2004)	Being comfortable with disagreements or suitable handling of disputes.
(Tariq et al., 1998; Sheppard et al., 2004; Gibbings et al., 2007; Mohd-Yusof et al., 2013)	Deciding the best solution during solving a problem in a group.
(Bacon et al., 1999)	Delegating task equally.
(Tariq et al., 1998)	Being creative.

However, teamwork assessment holds a number of challenges – in particular how work can be fairly and consistently assessed individually and how students can be encouraged to actively participate with the group work itself (Crotty, 1998). A frequent criticism of teamwork assessment is that each to individual team members often received the same group mark with regards of the contribution (Wellington et al., 2002). The assessment requires the assessor to observe the individual's capability of developing the skill. Research by Hellström et al. (2009) suggested the majority of students prefer some kind of individual grade in the teamwork assessment. From the educators' perspective, ensuring that all individuals reach the learning outcomes at the same time has been identified as a challenge. At the same time educators find it frustrating to make individual assessments during the group work.

It is not an easy task to observe the behaviour patterns of a good group (Marin-Garcia et al., 2008). Flynn et al. (2004) added that team assessment also needs to address a number of issues including: the problem of "passengers", problems with bias, students' differing perceptions, and many subtle social pressures that need to be resolved (p. 150). Similarly, Kalliath et al. (2006) and Willcoxson (2006) described the aspect that most concerns both students and lecturers during group work: that is the opportunist or parasite behaviour of some group members. The problem frequently occurs when group work takes place outside class hours (Sheppard et al., 2004) and when the group has four or more team members (Bacon et al., 1999). To prevent parasite behaviour patterns in students, research by Marin-Garcia et al.

(2008) suggested limiting observation of behaviour patterns of individuals to the summative assessment of the group, including the degree of participation of group members.

2.5 Employers' Perceptions of Generic Skills and its Challenges

A review of recent literature in various sectors (business, social science, bioscience and engineering) suggests rapidly growing interest among universities around the world in becoming engaged with employers and industry bodies to investigate their perceptions of students' and graduates' performance especially in generic skills, for example in: Australia (Gunasekara, 2004; Nair et al., 2009; Shah et al., 2011), Malaysia (Husain et al., 2010; Mai, 2012; Selvadurai et al., 2012; Puteh et al., 2013; Saad et al., 2013), the United Kingdom (Morley et al., 2007; Saunders et al., 2010; Lowden et al., 2011) and Sri Lanka (Wickramasinghe et al., 2010).

The technical ability of engineering graduates has become a central criticism from employers which relates to a lack of skill as well as competencies in basic mathematics and science, and issues relating to being able to apply basic knowledge to real engineering problems in industry (Polanco et al., 2004; Gibbings et al., 2007). Olsson (2005) acknowledged the increased importance of generic skills in the work life of engineers and attributed this change to the shift from an industrial to a knowledge-oriented economy.

In their research on employers' perceptions of engineering students, Saad et al. (2013) recommended that HE institutes should pay equal attention to hard or technical skills and to generic skills (p. 46). Previous studies also confirmed equal importance for both skills sets (DEST, 2006; Zaharim et al. 2009; Mohd-Yusof et al., 2015). A lack of generic skills has been cited as one of the reason students struggle to find employment (Andelt et al., 1997; Briggeman et al., 2007; Agus et al., 2011). Employers requires graduates to have technical and competence in their chosen discipline; but at the same time potential employees need to demonstrate a range of skills, such as communication, critical thinking and problem-solving (Lowden et al., 2011; Mason et al., 2011). Indeed, such attributes appear to be critically important in employment as Briggeman et al. (2007) summarised in saying that *"employers make hiring decisions based on the perceived attributes of job candidates"* (p. 20).

Fresh engineering graduates find themselves facing more challenges in securing a career compared to previous graduates (Mohammad et al., 2004). Coughlan (2012) reported in BBC Education and Family, that too many young people are lacking in the social skills needed to get their first job and Organisation for Economic Co-operation and Development (OECD) classified the matter as an *"international problem"*. HE is not to be blamed as cited by Mai

(2012); Ever and his colleagues found that: *“Higher Education is not doing poorer, but it is skills demanded by employers that have increased”* (p. 44).

There is clearly a need for HE institutes to work more closely and maintain a constant engagement with employers to detect changes in industry – not only on the current technologies used but also on updates of skill expectations from employers – for better equipping their students and to increase employment opportunities and prospects (Shah et al., 2011; Saad et al., 2013). The globalisation of engineering work requires generic skills to be up to date and improve as needed in the workplace (Zaharim et al., 2009; Mason et al., 2011). Rosenberg et al. (2012) suggested further studies should investigate the competency skills levels that employers expect of generic skills market, as the employers are familiar with the required skills for most jobs in the current labour market (p. 16).

2.6 Active Learning (AL) Approaches in Engineering Education

A variety of AL approaches are useful to enhance students’ understanding of learning concepts, and ultimately to create a learning and teaching environment that is interesting, active and more meaningful for students (Tileston, 2005). Kearns (2001) and Ballantine et al. (2007) also discussed different approaches and suggested that, through the implementation of active learning strategies, students are not only responsible for their own learning but also develop generic skills at the same time. What is learnt by the students is more important than what the teacher does (Shuell, 1986). Another benefit of active learning was noted by Nelson (2010), who contested that students learn two to three times more when using active learning techniques than by being taught through traditional lecture methods only (pp. 122-123). Whilst Prince (2004) stated that active learning results in significantly improved recall of information.

The different methods of active learning that are most frequently discussed in the Engineering Education literature are: Co-operative Learning, Collaborative Learning, Conceive-Design-Implement-Operate (CDIO), Project-Based Learning (PjBL), Problem-Based Learning (PBL) and Work-Based Learning (WBL). The methods require students to take on active learning strategies and adopt a self-directed learning disposition (Mohd-Yusof et al., 2004). Each of these is now briefly discussed.

2.6.1 Co-operative Learning

Co-operative learning is defined as a structured form of group work whereby students have to achieve common goals and be assessed individually (Panitz, 1996; Prince, 2004). In brief, Felder et al. (2007) described co-operative learning as an approach to teamwork that minimises those unpleasant situations and maximises students’ learning and satisfaction. They further stated that co-operative learning only qualifies if five listed elements are present:

positive interdependence; individual accountability; face-to-face promotive interaction; appropriate use of collaborative skills, and group processing. Unlike less structured forms of collaborative learning, co-operative learning requires students to be responsible for their own learning. Ballantine et al. (2007) claimed co-operative learning to be affective in delivering generic skills. Moreover, this kind of learning promotes students critical thinking, achievement and problem-solving skills (Maceiras et al., 2011). Therefore, the teacher or facilitator needs to carefully design the learning activities and regularly monitor them (Smith et al., 2005).

2.6.2 Collaborative Learning

Collaborative learning refers to an instructional method in which students at various capabilities and achievement levels work together in small groups towards a common goal (Gokhale, 1995). As such, collaborative learning can be viewed as encompassing all group-based instructional methods (Prince, 2004). Prince (2004) also added that some authors distinguish between collaborative and co-operative learning as collaborative learning places emphasis on students' interaction rather than on learning. Taking an Engineering Education perspective, Shen et al. (2007) described collaborative learning as the way people collaborate and interact on an engineering project, regardless of their geographic locations and means of interaction. This means collaborative learners do not have to be co-located.

2.6.3 Conceive-Design-Implement-Operate (CDIO)

Another method of active learning is CDIO. CDIO was originally conceived at the Massachusetts Institute of Technology (MIT) in the late 1990's. Since 2000 CDIO membership has spread across all regions in the world: Europe, North America, Asia, Latin America, the UK and Ireland, Australia, New Zealand, and Africa (CDIO, 2016). Berggren et al. (2003) briefly described CDIO as follows.

Conceive Defining the need and technology, considering the enterprise strategy and regulations, developing the concept, architecture and business case.

Design Focusing on creating the design, which is the plans, drawings and algorithms that will be implemented.

Implement Transforming the design to the product, which includes manufacturing, coding, testing and validating.

Operate Using the implemented product to deliver the intended value, which includes maintaining, improving and retiring the system.

The CDIO syllabus was constructively aligned with the learning outcomes, curricula, teaching approaches, students' learning assessment and programme evaluation (Crawley et al., 2011).

The objective of CDIO is to educate students to be modern engineers, capable of participating and becoming leaders in the field (Palma et al., 2011). It is derived from the statement that *"engineers engineer"* and run based on a specific standard syllabus that focuses on fundamental engineering skills and competencies (Bankel et al., 2003). In order to achieve its purpose, CDIO provides students with *"Engineering Fundamentals"* set within the context of conceiving, designing, implementing, and operating industrial systems, industrial equipment and products (Crawley et al., 2007). Bennett et al. (2010) listed four overall goals for CDIO, which are that students should have:

- A deep working knowledge of technical fundamentals.
- A refined ability to discover knowledge, solve problems, think about the systems, and master other personal and professional attributes.
- An advance ability to communicate and work in multi-disciplinary teams.
- Skills to conceive, design, implement and operate systems in an enterprise and societal context (p. 215).

2.6.4 Project-Based Learning (PjBL)

A project is defined as a complex effort that necessitates an analysis of the problem that has to be planned and managed, because any changes in people's surroundings, organization, knowledge and behaviour need to be considered (Algreen-Ussing, 1990, cited in Kolmos et al., 2007). PjBL is grounded on a constructivist approach to learning, specifically within Vygotsky's theories (Wertsch, 1986). It entails the construction of knowledge from multiple perspectives (Cunningham et al., 1996). In this respect, Kubiatko et al. (2011) described PjBL as a process of solving a problem using a project in a students' group work which ends with the creation of a product, such as a thesis, report, system, design plan or model. With this teacher-facilitated approach to learning, students drive their learning through inquiry, as well as work in a group to research and implement projects which reflect their knowledge (Bell, 2010). Grant (2002) discussed common features of PjBL implementation as involving activities, tasks, investigations, finding information from multiple resources, scaffolding, collaboration, and providing opportunities for reflection.

Many authors have examined the effect of PjBL on learning outcomes. For example, Neo et al. (2009) stated the effect of PjBL on learning outcomes is that it can increase students' motivation, critical-thinking skills, communication skills, and also promote effective team working. Negotiating how to collectively solve a problem is also an outcome of PjBL (Bell, 2010). Moreover, Moalosi et al. (2012) revealed that students attain most of the desired graduate attributes, such as creative- and critical-thinking skills, accountability and ethical standards through PjBL. Likewise, Prince et al. (2006) noted that the culmination of the project is normally a written and/or oral report summarising the procedure used to produce the product and presenting the outcome (p. 14). Additionally, Hernández-Ramos et al. (2009) indicated students in PjBL do not limit themselves to reporting facts but develop the ability to interpret the information, are more encouraged to conduct presentations collaboratively and are motivated towards their learning.

PjBL has been adopted in a wide range of disciplines. However, according to Mills et al. (2003), PjBL is more appropriate in the engineering profession, since the concept of the project becomes more relevant in graduates' professional practice. Many engineering programmes adopted PjBL in their institute such as : Civil, Mechanical, Electronic or Computer and Manufacturing Engineering at Trinity College Dublin (Bennett et al., 2010); Chemical Engineering (Crosthwaite et al., 2006); Electrical Power System Engineering (Hosseinzadeh et al., 2012); Industrial Design Engineering (Moalosi et al., 2012), and Electrical Engineering (Lei et al., 2012). Furthermore, research by Noordin et al. (2011) compared two active learning approaches: PjBL and PBL. Their research concluded that PjBL is the best method to equip engineering students with 21st century skills as compared to PBL, because the approach is closer to real-life engineering practice.

2.6.5 Problem-Based Learning (PBL)

PBL is described as the learning initiative from the outcome of the process in understanding a problem (Wood, D. R., 1994, cited in Northwood et al., 2003). PBL was first developed for medical education in 1969 in the medical school at McMaster University, and since then the approach has become common in medical institutions (Walker et al., 2009; McFalls, 2013). The approach is also largely conceived and developed in other discipline, initially for training lawyers and clinical practitioners, and then subsequently adopted for other professional courses (Savin-Baden, 2000). Nevertheless, it is just as appropriate for engineering subjects, consumer sciences, and traditional academic subjects (Ward et al., 2002; Northwood et al., 2003).

PBL is an alternative approach to learning that facilitates a multitude of strategies critical for success in the 21st century (Bell, 2010). The main goals of PBL are: to promote deep learning (Woods, 2003); to help students develop their generic skills such as flexible knowledge, effective problem-solving, self-directed learning, effective collaboration and intrinsic motivation (Tchudi et al., 1996; Hmelo-Silver, 2004; Gibbings et al., 2007); higher-order thinking; multi-disciplinary learning; independent learning; teamwork and communication - all of which motivate students to prolong lifelong learning (Paul, 2010).

In PBL, students are responsible for their learning. Masek et al. (2010) and Mohd-Yusof et al. (2004) described PBL as another method which results in Student-Centred Learning (SCL).

SCL is an innovative learning method that is believed to increase student engagement in the learning process (Masek et al., 2010). Lecturers act as facilitators, moderators or advisors (Ward et al., 2002) to oversee each step of the process, give reflection and discuss each choice, before the student starts off in their particular direction (Savin-Baden, 2000). SCL has also been highlighted as an important element in educational policy. For example, the Bologna process in Europe emphasised the need for more SCL in intended learning outcomes (Communiqué, 2009).

PBL is in contrast to traditional approaches which are teacher centred and where knowledge is limited to the teacher and textbook (Northwood et al., 2003). In order to create a student-centred approach through PBL, it is necessary that faculties give up traditional ways of instruction and places the responsibility for learning directly on the student (Ozbicakci et al., 2012).

Claims made with regards to the value of PBL in HE suggest that it represents *"an effective method for professional education programmes and across Higher Education of relevant professional problem-solving"* (Murray-Harvey et al., 2005, p. 257). However, Kolmos (2010) and Prince (2004) argued, based on the literature, faculties adopting PBL are unlikely to see improvement in student test scores, but are likely to see improved students' attitudes, behaviours and habits in learning independently. Othman et al. (2009) provided three principles of how PBL can specifically affect engineering students in their learning process.

i. Students realise the importance of changing their perspective about learning.
ii. Students pay more attention to the process, rather than concentrating on the end product of learning.
iii. Students experience more opportunities of learning activities (p. 9).

Guidelines have been developed by researchers to change the traditional curriculum to a PBL curriculum (Paul, 2010), the roles of the management in implementing PBL in institutes (Kolmos et al., 2007; Kolmos, 2010); and the role of tutors (De Grave et al., 1999; Wee et al., 2001).

Jonassen et al. (2006) claimed that adopting PBL in the curricula helped to prepare engineering graduates to become better workplace problem-solvers. Many educators and researchers around the world have tried, tested and delivered the majority of their curricula via PBL and there is evidence from a growing literature on the use of PBL in various engineering degree programmes. Table 2-8 summarises the universities involved in delivering their engineering programmes via PBL according to its country.

Table 2-8 Engineering programmes delivering their engineering programme via PBL (Source: author)

Country	University	Engineering Programme
Australia	University of Southern Queensland (Gibbings et al., 2007)	Agricultural, Civil and Environmental Engineering; Electrical Engineering; Electronic and Computer Engineering; and Mechanical and Mechatronic Engineering.
Malaysia	University of Malaya (Said et al., 2005)	Electrical Engineering
	Port Dickson Polytechnic (Krishnan et al., 2009)	Electrical Engineering
	University of Technology Malaysia (Mohd-Yusof et al., 2004)	Chemical Engineering
Denmark	Aalborg University (Kolmos et al., 2013)	Civil Engineering; Mechanical, Production and Management Engineering
India	Shri Ramswaroop Memorial Group of Professionals (Yadav et al., 2011)	Electronics and Communication Engineering
United States of America	Carnegie Mellon University, Pittsburgh (Cline et al., 1997)	Chemical Engineering
	George Institute of Technology, Georgia (LaPlaca et al., 2001)	Bio-Medical Engineering

The change to the PBL approach is not dependent on individuals. The organizational levels, especially the management of an institute, have to involved to ensure the successful of the approach (Scott, 2003). It is not surprising if academic staff feel confident and satisfied with their existing teaching practice. However, management should establish a process where academic staff reflect on the advantages and disadvantages of the current practice, and also provide awareness of alternative practices, such as PBL (Kolmos, 2010). Another suggestion, described by Kolmos (2010) for encouraging teachers to change their approach, is to set a vision of the HE institution. Academic staff should be involved during the process in order to create ownership and motivation. Jamison et al. (2014) also agreed with Kolmos' statement, and described the process of changing the curricula as also a process of changing the university's mission and vision (p. 265). Jonassen et al. (2006) suggested that engineering faculties that lacked support to develop PBL can utilise the online application to support PBL environments.

When academic staff change their role to facilitators, moderators or advisors, it is important to ensure students' engagement with their learning. Students' engagement is *"the extent to which students are actively engaged in, or committed to and actively involved in their own learning"* (Markwell, 2007, p. 6). Academic staff should make themselves available to consult with students outside the classroom (Weinert, 1999), make the students feel comfortable, and create the sense of belonging to a learning community (Coates, 2005). In addition they should motivate students to co-operate with each other by structuring the team when performing group work (Koppenhaver et al., 2003). Similarly, Markwell (2007) briefly described several elements that can contribute to student engagement. Among the elements are:

- Attendance at and active participation during class.
- Clarification of what students have learnt in class, along with discussing other aspects of their lives.
- Collaborative work and motivation of students to establish informal communication among peers.
- Interaction with surrounding people, such as academic staff, support staff and others.
- A sense of belonging to the community, university or college (p. 6)

2.6.6 Work-Based Learning (WBL)

The WBL approach is a collaboration between HE institutions and industry with the objective of providing students with the opportunity to learn in the workplace (Boud et al., 2001). Students' learning happens when classroom instruction is linked with a workplace skill through placements outside the school. This allows students to experience first-hand the practices of industry (Rogers-Chapman et al., 2013). WBL is an approach that perceives learning as continuous process grounded in experience (Sangster et al., 2000). Rasul et al. (2014), in short, described WBL as a learning experience in real-work situations that develop meaningful constructs. However, Richard (2013) argued that students' learning in WBL not only happened within the work environment but also included the home, the community and recreational pursuits. For Richard, WBL is a subset of experiential learning which was set out by Dewey (1998). However, Lester et al. (2010) regarded WBL as overlapping with experiential learning but not being the same.

Maclaren et al. (1998) described that, in WBL, the students' learning process focuses more on people than systems highlighting human factors instead of mechanical processes (p.10). From a pedagogical perspective, these experiences offer genuine benefits to students' learning and development of generic skills. For example, WBL is used to engage students with applied learning in practical settings (Rasul et al., 2014), increasing individuality and appropriate behaviour (Helyer, 2011), and developing problem-solving skills (Fink, 2001;

Lasonen, 2005). Rogers-Chapman et al. (2013) in their research briefly described the benefits of WBL as follows:

- Connections between the classroom and real-world learning
- High student completion rates
- Student ownership
- Development of generic skills (p.2)

Hence, with close collaboration with industries, it is claimed that WBL could produce graduates with good competency level and to meet industry needs and requirements (Rogers-Chapman et al., 2013; Watisin et al., 2014). WBL requires students to be active when learning to benefit from the approach (Walsh, 2006). This shift towards active, self-directed learning by students is seen as supporting the thrust towards emphasis on a higher order of competencies in the process of general education (Kearns, 2001). Yet, the literature identified the success of WBL as not only relying on students' participation but also the competency of academic staff in delivering the knowledge and skills (Rasul et al., 2014).

2.7 Constructive Alignment Theory

Constructive Alignment was originally conceptualised as an integrative model and based on constructive learning theory (constructivism) to improve teaching at the classroom level (Biggs, 1996). Biggs (2003b) described Constructive Alignment as being built up based on two thrusts:

- "Constructive" – refers to the idea that students construct meaning after undergoing relevant learning activities; the objective for students is to be responsible for their learning.
- "Alignment" – refers to what the instructor provides to support the learning activities and the assessment to check that the intended learning outcomes (ILOs) have been achieved.

In order to classify the teaching and learning process, Biggs et al. (2001) advocated the "3P" approach which consists of stages of presage, process and product, see Figure 2-2. The principles of holism and alignment are the key in this approach (Kolmos et al., 2007). Presage involves consideration of the students' prior knowledge and ability that affect learning. Process is the learning activities for the students to engage in and instructors to motivate students to reach the ILOs. Product refers to various demonstrable, desired outcomes from the learning activities. Indicators of students achieving the ILOs could be their grade, competencies, change of behaviours, degree completion, and so on (Ramsden, 2003). Aligning the "3Ps" will confirm compatibility and consistency between the curriculum, learning and teaching approach with the assessment (Biggs, 2011).

In designing the appropriate learning activities for the students, the instructor should aware that each student takes a different approach to learning and have different level of cognition (Biggs, 1987; Wang et al., 2013). Similarly, the subject matter needs to identify the desired level of understanding by stipulating the appropriate verbs, which are later used to measure the students' performance (Biggs, 2003a). This identification is fundamentally important when structuring the teaching and learning activities (Walsh, 2006).

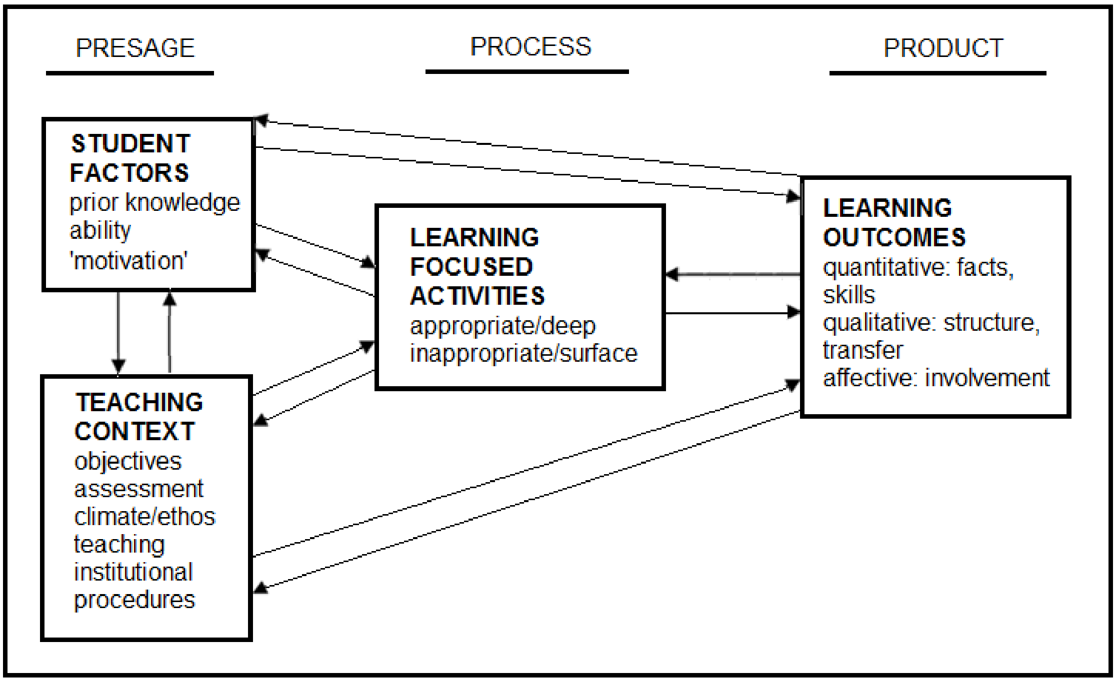

Figure 2-2 The "3P" model of teaching and learning (Biggs, 1999, cited in Kolmos et al., 2007)

To determine the students learning, it is best to look at what the students does than what the instructor does (Shuell, 1986). On the other hand, Biggs (2011) suggested, to enhance students' learning and facilitate students' achievement, the instructors adopting Constructive Alignment should:

- Clearly specify the ILOs.
- Design the appropriate learning activities for students to construct their knowledge to achieve the ILOs.
- Establish the assessment criteria.
- Provide students with time for reflection for continuous improvement.

Biggs (2011) claimed that Constructive Alignment would lead students to engage in a deep learning approach. A deep learning approach helps students to construct meaning and understand what they have experienced in learning (Biggs et al., 2010). Likewise, Constructive Alignment supports students' learning and reflects the shift from teacher-centred teaching to student-centred learning (Wang et al., 2013). It ensures that students are more prepared for their professional roles (Walsh, 2006). Walsh further claimed that Biggs' Constructive Alignment could be better used in a WBL environment, as it could help to identify the students' learning experience in the institution and the learning experience in the workplace (p. 82).

2.8 Consensus Theory of Employability

Consensus Theory of employability offers alternative interpretations of the changing relationship between education, employment and the labour market (Brown et al., 2003). Brown briefly explained that the theory places an emphasis on what social groups (employer, academia and employees) have in common, often relating to what are present as the current social norms or cultural shared beliefs to understand the employability. As such, consensus between individuals and social institutions can sustain equilibrium (Jonck et al., 2015).

However, technology is seen to be the driving force of social change which places increasing demands on the workforce (Webb et al., 2006). Technological innovation and development, globalisation and the shift to a knowledge economy also create changes in the current labour markets and this places further requirements of new graduates to excel in academic areas and enhance their generic skills (Leggatt-Cook, 2007; Selvadurai et al., 2012).

According to Leggatt-Cook (2007), there is serious mismatch between labour demand and supply, as the knowledge economy no longer views low-skilled workers as "employable". However, to overcome the issue, she further suggested that an investment in the growth of human capital may promote further innovation and enterprise, lead to the development of high-skilled workers and high-salary jobs, put an end to poverty and social exclusion, and lastly secure national competitive advantage (p. 12). Selvadurai et al. (2012) also agreed about the effect of human capital injection, and suggested that by equipping graduates with appropriate skills at the tertiary level, chances of employability are increased and the economy boosted.

However, according to academic literature, there are limitations with regards to the Consensus Theory. For example, students acquire generic skills before arriving at university, in environments such as the school, the family, the neighbourhood and workplace, and in a variety of social settings (Selvadurai et al., 2012). Besides, in Consensus Theory, Higher Education tends to be blamed for not inculcating sufficient skills through curriculum design and through appropriate pedagogical methods (Paadi, 2014).

2.9 Summary

This chapter analysed the background (within accepted literature) of the assessment of engineering students' generic skills within AL environments. The terminology of generic skills, competencies and attributes used in engineering perspectives, various active learning approaches used in the development of generic skills, the importance of generic skills in the workplace and employers' perceptions of these skills are all discussed in this chapter. This chapter has also highlighted the generic skills assessment methods through active learning approaches and the problems faced in verifying assessments within AL. Lastly, the Constructive Alignment Theory and Consensus Theory of Employability are also presented.

3. Methodology

3.1 Introduction

The aim of this chapter is to describe the methodology and research design that has been applied in this study. The chapter begins by highlighting the aims, objectives and research questions to be answered in the study. This is followed by the philosophical underpinning of the thesis as well as the conceptual framework. Subsequently, the research methods and design are discussed. The methodological approach adopted involves: case study and multiple case study design. Following a description of the sampling approach, the methods that have been used and the data analysis approach are outlined. Finally, the chapter clarifies issues of validity and reliability that have been considered whilst undertaking the study. Ethical issues are also discussed before the research timeframe is presented.

The research aims to investigate generic skills assessment within an AL environment in the Malaysian Engineering Education. In order to provide a valid and reliable piece of research, an assessment framework is designed to measure generic skills. Particular attention is paid to generic skills most relevant in the field of engineering including: problem-solving, verbal communication and team working.

The research objectives, as discussed in Chapter 1, are:

1. To critique the existing methods of assessing generic skills in the context of Engineering Education within an AL environment based on the literature.
2. To collect data from two case study institutions in a range of different forms that then allows the integration of this data with the literature.
3. To develop a framework to guide the assessment of generic skills in an AL environment.

The primary research question is: **How are generic skills assessed within an Active Learning (AL) environment in the Malaysian Engineering Education?** In order to closely examine the relevant issues, five sub-research questions are identified which reflect the context of Engineering Education and AL environments. The research questions relating to engineering students and lecturers/mentors are: -

1. How is AL being implemented?
2. How is generic skills assessment implemented?
3. What are lecturers'/mentors' experiences of generic skills assessment?
4. What are students' experiences of generic skills assessment?
5. What generic skills attributes do employers expect engineering graduates to possess?

3.2 Research Philosophy

The nature of truth in social science and educational research relates to two philosophical perspectives: ontology and epistemology. Porta et al. (2008) defined ontology as about *"what we study"* in terms of it being the object of investigation while epistemology is about *"how we know things"* and *"a branch of philosophy that addresses the question of the nature, sources and limits of knowledge"* (p. 22). The following sections further discuss and justify why the paradigm is selected for the context of this study.

3.2.1 Interpretivism

Despite positivist stances, interpretivism acknowledges that phenomena can be interpreted differently (Burgess et al., 2006), and captures the different interpretations of a phenomenon by research subjects (Tangney, 2011). To minimise the researcher bias, Tangney (2011) suggested that ongoing reflexivity with respect to the interpretation of the data is necessary. Bryman (2012) defined interpretivism as *"based upon the view that a strategy is required that respects the variances between people and objects of the natural sciences and thus requires the researcher to grasp the immanent significance of social action"* (p. 30). Humans are influenced by their lived experiences, and will always make sense of the knowledge they generated as researchers and by their subjects accordingly (Lincoln et al., 2011). Interpretive approaches rely heavily on naturalistic and qualitative methods such as interviewing, observing and analysing existing texts (Angen, 2000). Angen (2000), in particular, also highlighted that these methods ensured an in-depth conversation between the researchers and the participants in order to collaboratively construct a meaningful reality.

3.2.2 Constructivism

Objectivist theories, with their links to positivism, lead to assessment policies and practices, but frequently neglect the quality of learning and teaching (Frederiksen et al., 1989; Biggs, 1996), and are more concerned with quantitative evaluation and having an analytic mind-set (Biggs et al., 2010). Nevertheless, constructivism rejects objectivism, claiming to see the human as central in the creation of knowledge (Biggs, 1996), seeing learning qualitatively, socially involved and holistically placed wherever possible (Cole, 1990; Biggs et al., 2010).

Prince et al. (2006) referred to constructivism as when an individual act to *"actively construct and reconstruct their own reality in an effort to make sense of their experience"* (p. 4). Constructivism is represented as many things: a theory of learning, teaching, education, cognition, personal knowledge, scientific knowledge; from a world, individual, social and post-modern viewpoints (Steffe et al., 1995; Biggs, 1999b; Matthews, 2002). According to Crotty (1998), in the constructivist philosophy, the methods and methodology used are based on researcher assumptions and interpretations about reality that are dependent on his/her own perspective. Baxter et al. (2008) agreed with Crotty (1998), adding that a constructivist recognises the significance of the subjective human creation of meaning, but somehow does not reject outright some notion of objectivity. In discussing constructivism, Crotty (1998) identified several assumptions as cited by Cresswell (2009):

- Meanings are constructed by human beings as they engage with the world they are interpreting.
- Humans engage with their world and make sense of it, based on their historical and social perspectives.
- The basic substance is always social, arising in and out of interaction with the human community (p. 8).

Coll et al. (2001) adopted a constructivist point of view and contended that knowledge is simply justified rather than verified. As such, being a researcher, he/she must actively participate in, and focus on, the research process with their subjects to ensure the knowledge that is produced is reflective of their reality (Lincoln et al., 2011). The task of the researcher in this study is to understand the human's perspectives despite the limitations of the methodology.

3.2.3 Researcher's Ontological and Epistemological Position

The research in this thesis was designed to employ multiple case studies within an AL environment in the HE sectors of Malaysia. The researcher's ontology of this study is grounded by his belief in the knowledge and generic skills constructed from human behaviour, underpinned by a constructivist philosophy. From an epistemological perspective, the researcher was educated and trained in Microelectronics and Communication Systems Engineering and for a decade has worked as a Mechatronics Engineering lecturer at the German-Malaysian Institute (GMI). Furthermore, the researcher's epistemology is interpretivism, because learning is constructed from the students', lecturers'/mentors' and employers' experiences and perceptions within a natural setting. According to Guba et al. (2005), there are three primal principles in particularly recognised in interpretivism: critical theory, constructivism, and participatory paradigms (p. 195).

Constructivism is chosen to acknowledge that knowledge is socially constructed since it is the dominant view in the pedagogic literature. It acknowledges that an interview is an interaction, that the conversation is mutually constructed between the researcher and the participant (Guba et al., 2005; Lincoln et al., 2011; Silverman, 2011), and that is allows discussion (Tangney, 2011). As AL is incorporated within a Student-Centred Learning environment, it is an opportunity for the researcher to tease out understandings and form knowledge of generic skills and their assessment from research participants through semi-structured interviews, and later to map assessment practices through course documents.

Within this context of study, constructivism - influenced interpretivism underpins the researcher paradigm in conducting the research. As an interpretivist, the researcher principally emphasises the subjective meaning gained by interpreting the participants' social actions and perceptions. Thus, this study focuses on AL approaches in Malaysian HE settings and, in interpreting participant actions and perceptions, towards generic skills knowledge and its assessment. There is no hypothesis generated from the literature; in fact, setting a hypothesis and carrying out a large-scale survey, for example, is seen as detrimental to the study. An exploratory approach is thus considered as the most appropriate way to meet an understanding and answering the research questions.

3.3 Conceptual Framework

The conceptual framework is designed to provide methods that align generic skills assessment in Engineering Education with the attainment of active learning and teaching, and facilitate the achievement of the intended learning outcomes. It is also to accommodate the skills that employers expect a graduated engineer to possess. The conceptual framework for this study shown in Figure 3-1 consists of three concepts **(HE, labour market and employer feedback – Consensus Theory of Employability)**. The square boxes outside the big circle represent the input/feedback from industry into education practice. The circle comprises three concepts **(active learning and teaching, intended outcomes and generic skills assessment – Constructive Alignment Theory)**, this representing the implementation of the education system. The student is placed in the middle of the circle representing a student-centred approach.

Active learning is an instructional approach that actively engages engineering students in learning and has resulted in Student-Centred Learning (SCL) (Prince et al., 2006; Shi et al., 2012). As reviewed in Section 2.3, active learning is identified as an alternative approach adapted by lecturers or institutions to educate their students with knowledge in academic subjects and also to facilitate the students with generic skills, enhancing their prospect of employment. Active learning approaches such as PBL, WBL and others are widely commended constructivist pedagogy approaches with a high degree of alignment (Jones et al., 2002; Jervis et al., 2005).

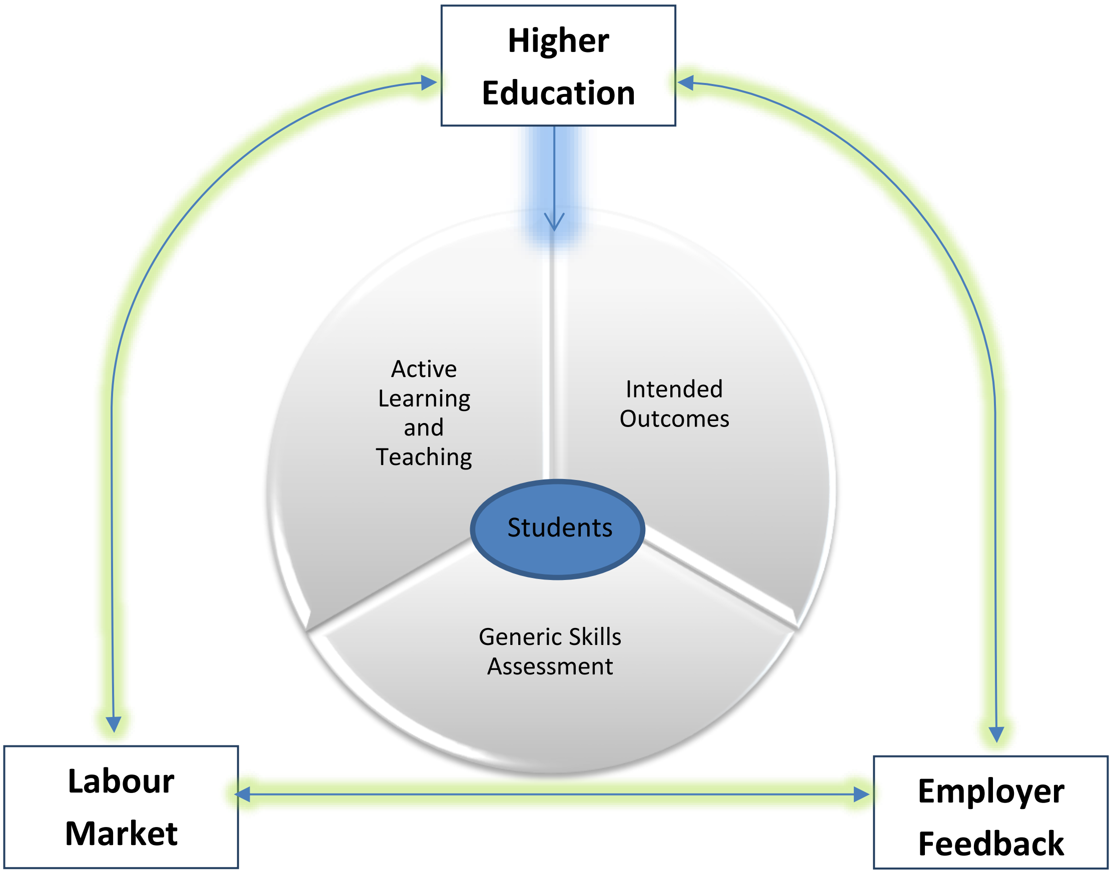

Figure 3-1 Conceptual framework (Source: author)

The alignment mentioned in the above sentence relates to the Constructive Alignment Theory that has been adopted to align the important implications for the learning and teaching approach, intended learning outcomes and assessment methods (Biggs et al., 2010). Biggs (1996) described Constructive Alignment as *"a marriage between two thrusts, constructivism being used as a framework to guide decision-making at all stages in instructional design"* (p. 347). In this conceptual framework, the intended learning outcomes for students become the objectives for designing the assessment process that enables students' generic skills achievements to be evaluated. However, MacDonald et al. (2010) argued that effective education and training in any country needs to be based on reliable labour market information, demand and employer needs, particularly in priority occupations (p. 2).

Thus, to answer the argument, this study integrates the Consensus Theory of Employability which is represented by the three square boxes outside the circle shown in Figure 3-1. The labour market and employer need to give feedback or input to HE institutions to improve practices. The feedback process is the connection between both theories. Brown et al. (2003) described the Consensus Theory of Employability as offering alternative interpretations of the changing relationship between HE, employment and the labour market. There is a need for HE – to implement wide initiatives to build employability skills (in particular generic skills) into the HE curriculum and policies, in line with the Consensus Theory of Employability (Fallows et al., 2000). Fallows et al. (2000) stated two key reasons for this: firstly, knowledge of an academic subject alone is inadequate in the current economic climate; secondly, graduates need to gain generic skills that will enhance their employability, and place them ahead of the pack in the current labour market.

Selvadurai et al. (2012) described the theory as being based on the belief that human capital injection, by instilling generic skills at the tertiary level, will ensure the employability of graduates and boost the economy (p. 296). An agreement between HE, the labour market and the employer in industry regarding the required level of generic skills is critically important. The relationship between these three stakeholders will reflect the way to inculcate sufficient skills in the Engineering Education curricular and curriculum design, policies and through appropriate pedagogical and assessment methods.

Authenticity in this framework is its focal point and it is based on interpretivism with constructivist elements. As an interpretivist, the researcher emphasises the subjective meaning gained by interpreting the participants' social actions and perceptions through the semi-structured interviews and course documents for the sake of the research aims and objectives. In this study, constructivism is necessary because its data is interpreted from the participants' reports of the phenomena that they have experienced.

As a conclusion, the researcher believes that the integration of Constructive Alignment Theory with the Consensus Theory of Employability acts as a foundation for a new generic skills assessment framework as an outcome of this study. The outcome may assure the alignment of HE policies, intended learning outcomes, pedagogical methods, assessments tasks and feedback from employers and the labour market (particularly with regards to generic skills perspectives). It may also be used to review and update the curriculum, assessment and learning/teaching approaches to enhance graduates' skills needed during professional practice.

3.4 Research Methods and Design

In social science research, the process of data collection and analysis is divided into two broad alternatives, quantitative and qualitative (Robson, 2011). Both of these terms provide much more than a way of gathering data; they represent the researcher's assumptions about the nature and purpose of research (Robson, 2011; Cresswell, 2012). Sarantakos (2005) described quantitative methods as being based on the methodological principles of positivism and *"generally geared towards documenting subject attributes expressed in quantity, extent, or strength, as well as guaranteeing – among other things – objectivity, accuracy, validity and reliability"* (p. 50). Whilst Robson (2011) described qualitative research as being based on constructivist philosophy and usually emphasising words presented verbally or in other non-numerical form in the data collection and analysis (p. 19).

These two methods may seem to be opposites, but they are both justifiable tools of social research, providing insights into human behaviour. Gill et al. (2002) suggested that the approaches should be viewed as neither better or worse than the other; instead, they are complementary.

There are many different quantitative and qualitative methods available in social science research. For instance, Cresswell (2012) recommended methods that can be uses in quantitative research, namely: survey questionnaires, standardised tests, randomised experiments, multivariate statistical analyses, and the like. In contrast, qualitative methods include: experiments, surveys, archival analyses, histories and case studies.

3.4.1 The Adopted Approach

In order to explain the adopted method used in this research it is important first to recall its aim. The research is aims to investigate generic skills assessment within AL environments in the Higher Education sectors of Malaysia, in order to provide a valid and reliable assessment framework. The study also attempts to measure generic skills, paying particular attention to the field of engineering, including: problem-solving, verbal communication and teamwork.

There are only a few references in the literature that discussed methods – and the importance – of assessing engineering students' generic skills generally and, in particular in AL environments. Moreover, there are also very few studies that investigated how generic skills (problem-solving, verbal communication and teamwork) are assessed in a manner – that truly reflects the demands of Higher Education and industry (for example, see Treleaven et al., 2008; Cajander et al., 2011). Thus, the researcher of this thesis has a low degree of understanding of the context. As a result, the nature of this research can be described as exploratory. Sarantakos (2005) stated that exploratory research is usually undertaken when there is not enough information about the research subject and aims to establish the most basic criteria of the research topic. Since exploratory research constitutes a central element of qualitative methods and offers support in formulating or testing hypotheses or theories (Punch, 2005; Sarantakos, 2005; Robson, 2011), it was decided that qualitative research would be fit for this research.

Using a qualitative approach enables the researcher to investigate the workings of the institutions and the relationships of the participants and their experiences (students, lecturers/mentors and employers). It also facilitates a description of significant research generated during the studies (Mason, 2002). Qualitative data insights gives the researcher an increased understanding of the whole picture because as an insider, his perspective provides power to qualitative reporting (Patton, 2005) and the capacity to constitute compelling arguments about how generic skills assessment is conducted universally.

As described earlier, there are several research methods that can be associated with the qualitative approach – one of which is the case study. The case study method forms the basis of the design for this research. An illustration and the justification of the method is presented in the next section.

3.4.2 Case Study

Yin (2014) provides guidance on three basic conditions that affect the selection of the case study method (see Table 3-1):

- The type of research question posed
- The extent of control a researcher has over actual behavioural events
- The degree of focus on contemporary as opposed to historical events

Table 3-1 Relevant situations for different research methods (Yin, 2014)

Method	Form of research question	Requires control of behavioural events?	Focuses on contemporary events?
Experiment	How, Why?	Yes	Yes
Survey	Who, What, Where, How Many, How Much?	No	Yes
Archival analysis	Who, What, Where, How Many, How Much?	No	Yes/No
History	How, Why?	No	No
Case study	How, Why?	No	Yes

From Table 3-1, it can be seen that a case study method is suitable for research that focuses on "how" and "why" questions, has no control over behavioural events and focuses on contemporary events. These three conditions can be applied to this research as follows. First, this research tried to answer questions of *how* rather than *what, who* or *where*. The research question is primarily: *How are generic skills assessed within an Active Learning (AL) environment in the Higher Education sectors of Malaysia?* Secondly, the research is conducted in the students', lecturers'/mentors' and employers' real-life situations and is focused on contemporary events in Higher Education and in industry. Finally, the researcher has no control over behavioural events.

Baxter et al. (2008) stated that, the aim of doing a case study is to explore and describe a phenomenon using variety of data sources, develop theory, test theory, evaluate programmes and develop interventions, because of its flexibility and rigour. It is an approach in which the investigator explores a bounded system (a case) or multiple bounded systems (cases) over time: through detailed, in-depth data collection involving multiple sources of information, and, from this, reports a case description and case-based themes (Cresswell, 2007). The data collection in case study research is typically extensive; for example, Yin (2003) recommended six types of information to collect: documents, interviews, direct observation, participant observation, archival records and physical artefacts. In brief, Yin (2014) described the case study as an approach which allows a researcher to explore individuals (students', lecturers'/mentors' and employers') or organisations (Higher Education), quite simply through interventions, relationships, communities, or programmes. Conversely, Robson (2002) maintained that case studies show what is taking place at particular places at particular times with particular people (p. 179).

One criticism of the case-study approach is that it can lack scientific rigour, particular as it does not address generalisability (Noor, 2008). Despite such criticism, case-studies are widely accepted in many social science studies; especially when in-depth explanations of a social behaviour, process, or a complex real-life activity is sought (Zainal, 2007). To answer the generalisability issue, Punch (2005) proposed conceptualising - that is, the researcher developing one or more new concepts to explain some aspect of what has been studied.

Yin (1994) case study framework has been used as a model in this study because it provides some general rules (p. 64). The framework includes:

- An overview of the case study project e.g., objectives, issues, interested topics.
- Field procedures e.g., credentials and access to sites, sources of information.
- Case study questions.
- A guide for reporting a case study e.g., the outline.

Figure 3-2 presents the research design (research procedures and data collection instruments) for this study. A multiple case study, fully qualitative approach has been adopted in which the following methodological tools are utilised: course documents and semi-structured interviews. The study seeks to explain and expand the findings of one method with another. Qualitative data sources include interviews with lecturers/mentors, students and employers. These have been employed to complement the qualitative information and to clarify reasons for patterns and differences in each case (Fraser, 2002).

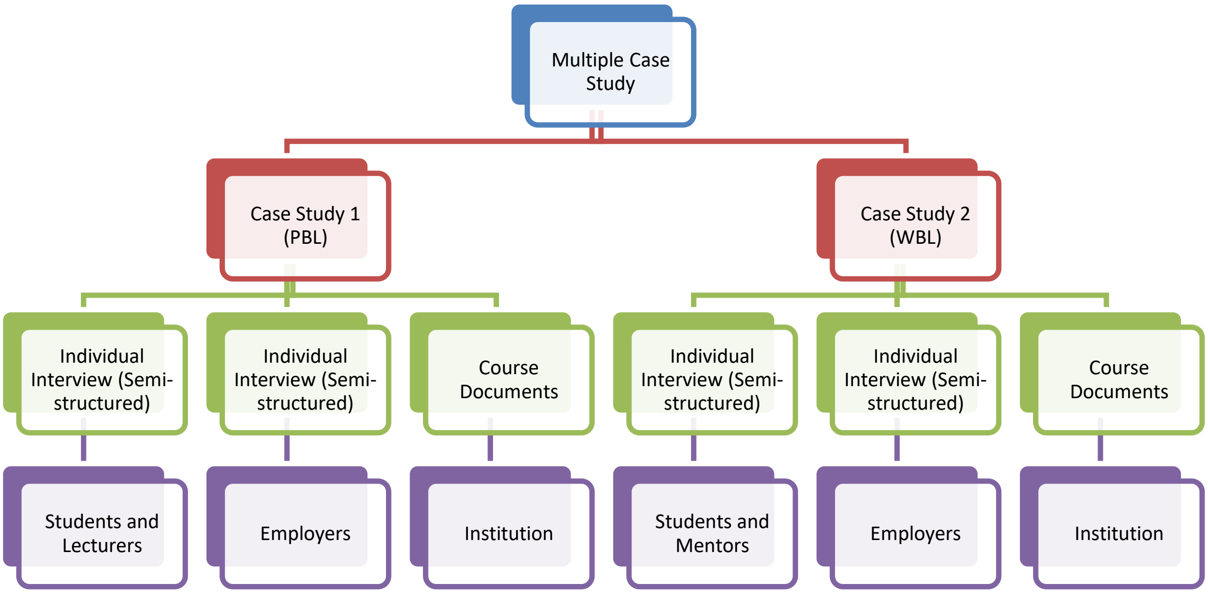

Figure 3-2 Research design (Source: author)

3.4.3 Multiple Case Study Design

In this research, the multiple-case study approach (Yin, 2014) has been adopted as shown in Figure 3-3. Multiple-case study analysis is chosen as the study investigates more than a single case in different AL environments. The amendments are shown in the green boxes and are made to fit the researcher's research design. The approach is chosen to increase external validity because comparative results, similar or contrasting data, could be analysed through individual case analyses and a cross-case analysis (Lockstroem et al., 2010). It is also an approach that suits the exploratory nature of the study and the complexity of the phenomenon under examination (Scarso et al., 2010) .

The case study design must first consist of theory development, showing where the researcher has analysed the literature on the assessment of engineering students' generic skills within the AL environment. Next, the cases are selected based on the specific measures according to the phenomenon being studied, aims and objectives, research questions, availability of data, and predetermined criteria in the design and data collection process (Robson, 2002). Then, a detailed case protocol is created in order to enable systematic data collection. For the purpose of this research, the researcher employs two case studies involving two HE institutions which implement partially/fully AL environments in their offered programme. The students, lecturers and the employers are determined important and bounded in the case. The study investigates the existing methods of assessing generic skills within the AL environment in selected Malaysian HE institutions in the engineering discipline.

The researcher is aware from the outset that the institutions' instructional systems chosen are different, which means their learning outcomes might also differ. There is potentially a contrast in situations, depending on the standards, culture and habits relating to institutional domains (de Bruijn et al., 2011). However Robson (2002) added that different outcomes are as important as those which are similar in data.

Then, the case study is piloted outside of the actual population study to avoid contamination of samples. This helps the researcher to "test run" or rehearse the case according to the intended research method, refine the data collection, check the validity and reliability of the instruments, and gain confidence to carry out the research within the environment in which it is to take place (Blaxter et al., 2006). Improvements are then made to the tools and protocols to make the approach more valid and reliable.

Data from the researcher's interpretation of events, behaviours and interactions taking place in the settings of participants becomes an evidence of each individual case study. The evidence is sought regarding the facts and the conclusions within the case. As Yin (2014) suggested for each individual case: the report identifies how and why generic skills assessment was established (or not established). When looking across cases, the report should indicate the extent of the replication logic and why some cases produced contrasting results. Findings for the individual and the multiple cases are described briefly in the following chapters.

Data from both cases is meta-analysed, diligently coded and cross-validated across the typology of recurring themes and codes. The importance of cross-case analysis is to enhance generalisability, and to deepen the understanding and explanation (Miles et al., 1994) of generic skills assessment in each case. Jensen et al. (2001) stated in meta-analysis, the researcher can create a summary table that consists of cross case comparison where the rows are case studies and the columns are related attributes or findings, or vice versa. It is then used to develop a tool with which to evaluate the engineering students' generic skills in the two studied AL environments.

The blue dashed-line feedback loop in Figure 3-3 represents the researcher's consideration if the case does not in fact suit the original design. The researcher also considers redesigning the approach, if necessary, either involving the selection of alternative cases or changes in case study protocol. This is done to avoid accusations of being selective in reporting the data and distorting the discovery for the purpose of suiting original theoretical propositions.

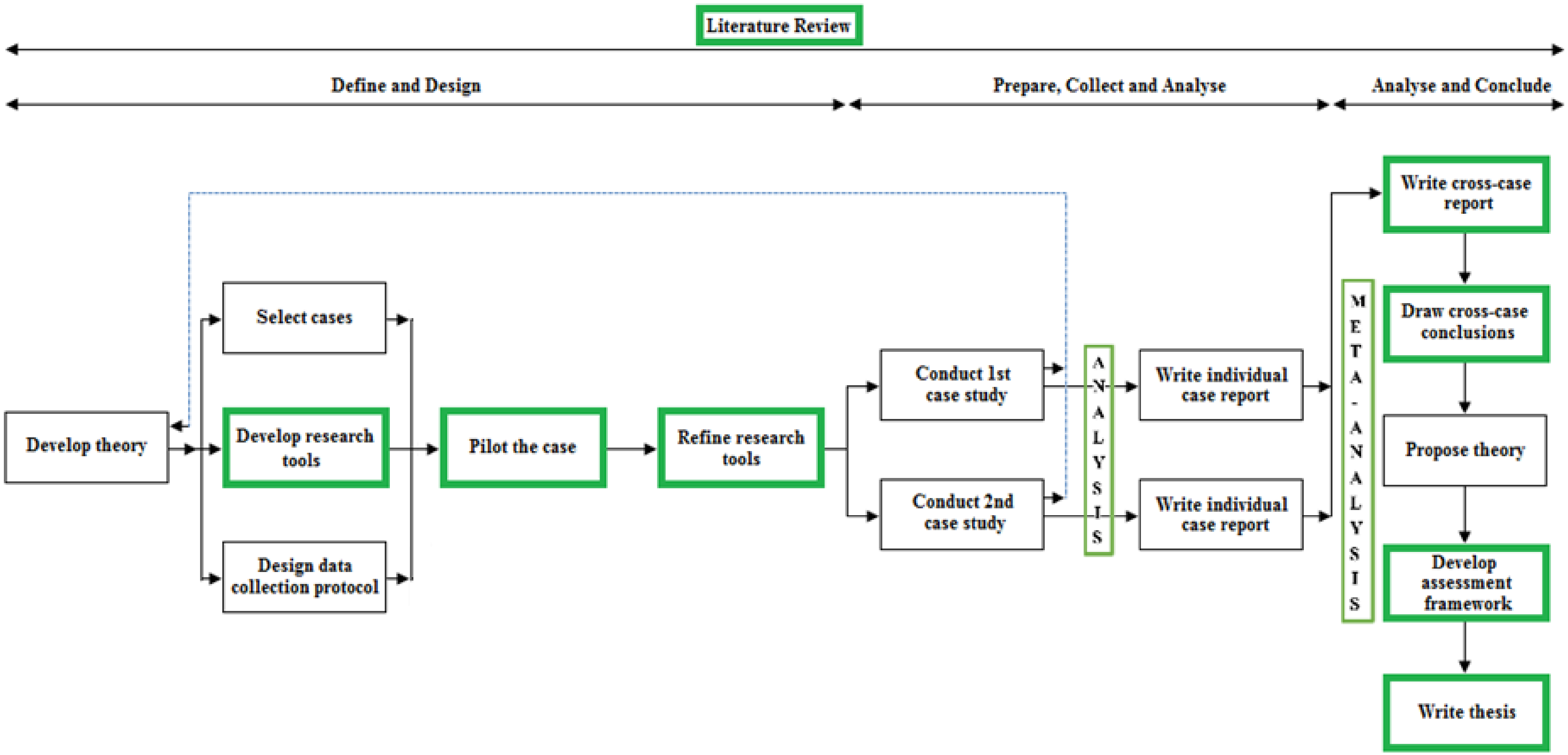

Figure 3-3 Multiple-case study design (adapted and amended fromYin, 2014, p. 60)

3.4.4 Sampling Approach and Framework

The study adopts a purposive sampling approach using predetermined criteria with the aim of identifying information-rich cases which can be studied in depth (Patton, 1990). The selection of the case studies are based on the knowledge of the sample population and the purpose of the study (Noor, 2008; Cresswell, 2009). This technique has various means of implementation. In this study, maximal variation sampling is used. This means that the researcher performs sampling based on different individuals characteristics (Mason, 2002; Cresswell, 2009). The inclusion criteria use for maximal variation sampling involves three different characteristics: Individual, Institutional Type and Discipline Focus.

1. **Individually Based**

In both case studies, the researcher begins the sampling process by having a discussion with a programme coordinator. The coordinators provide the researcher with a list of lecturers/mentors, students and employers. Then, the coordinators help the researcher to identify respondents that are suitable and available for the research purposes. Details of the sampling criteria are presented below.

<u>Demographics – social background:</u> – As Ong (2007) suggested, respondents are selected with different characteristics in terms of gender, ethnicity and level of achievement to reflect the wider students' population. Gender has been aligned with differences in generic skills' development (De Lange et al., 2006). For example, De Lange et al. (2006) claimed in the literature that some researchers reported that female students have significantly less writing comprehension than their male peers (p. 371). However, the focus of this study is on the assessment of generic skills, so, although recorded, the gender and ethnicity of the participants are not considered significant or requiring further exploration. Gender and ethnicity of the study and participants was recorded to allow the sample to be appropriately representative of the cohort as a whole but was not used as a variable in this study.

Rankin et al. (2003) claimed metacognitive knowledge differs between older students and recent school leavers and there is likely to be a difference in terms of preferences, attitudes towards study, and self-regulation (p. 372).

<u>Lecturers/mentors:</u> who have completed a recognised pedagogic preparation programme and have experience assessing generic skills within an AL are selected. Likewise, characteristics in terms of gender, academic qualification and level of position are also considered. Other relevant criteria are the number of years spent working in industry before becoming lecturers or mentors, and the number of years spent teaching. These criteria are critically important, because these lecturers or mentors are able to reflect on how their experience in industry helps them in developing students' generic skills and to share their actual experiences in teaching and the assessment process (Flynn et al., 2004, pp. 16-17). For Case Study 1, only seven out of 20 lecturers are selected to participate in this study; and in Case Study 2 seven out of 18 mentors are selected.

Final year students: who have been taught using an AL approach through to their final year of study. In Case Study 1, eight out of a total of 86 students are chosen to participate in the research; in Case Study 2, eight out of 19 are chosen. The students are categorised into three groups based on their academic performance (poor – CGPA 2.0 to CGPA 2.7, average – CGPA 2.71 to CGPA 3.4 and good – CGPA 3.41 to CGPA 4.0). The categories are decided through joint agreement between the programme coordinators and the researcher. For both case studies, two students from the "poor" group, three students from "average" group and three students from the "good" group are selected.

It is a common practice within the engineering curriculum to use design projects in the final year to give students hands-on, authentic experience and familiarity with current ways of working in the industry. The objective is not only teaching the application of engineering principles but also acquiring the required generic skills (Othman et al., 2010). The final year project module/subject is chosen because generic skills assessments represent a key aspect of the project as it will be assessed in authentic situations. Possibly, more pertinent in the final year of study is the preparedness for employment and achievement of skills (Tremblay et al., 2012). The final year project is always supposed to be challenging because it combines several skills (Krishnan et al., 2009). The project also is used as a tool to develop generic skills competencies and technical competencies as established in the course curriculum (Lima et al., 2007).

Employers/supervisors: who are involved in Mechanical/Electrical/Electronic disciplines and have experience in hiring engineering graduates who studied within AL environments. The coordinators from both institutions recommend five companies each. After considering the practicalities of transportation and the logistics of collecting data, all the employers are selected from within the Selangor area. The higher the number of graduates that work in the company, the more the employer is able to reflect on the graduates' generic skills performance. The reason for engaging with the employers/supervisors is also to identify and analyse the value of specific generic skills attributes and their level of satisfaction with graduates' generic skills. Mai (2012) in her research categorised employers as being the consumer of the HE product; thus, they are able to provide reasonable perceptions of students' competencies in the real work setting (p. 45). She then added that it is also crucial to investigate current needs of employers with specific references to develop an understanding of what employers' think are desirable competencies. The industry's involvement in course design is essential to ensure the right skills are provided to students (Peacock et al., 2002). The study will update the generic skills attributes that will further provide information as to the role of the respective institutions in developing and in assessing students' generic skills effectively.

2. Type of Institution

In setting the parameters for this study, the decision is taken to focus the fieldwork in Malaysian HE. Rankin et al. (2003) stated that institutional differences manifest in different learning styles, educational content and goals and the impact of metacognitive knowledge (p. 372). Two sites are chosen to encapsulate different institutional backgrounds: level of study, comparable learning approaches, similar educational and managerial policies and management approaches, and accessibility of data. Specifically, the research is conducted at two HE institutions in Malaysia under the Ministry of the Rural and Regional Department and the Ministry of Higher Education.

As explained earlier, in Chapter 1.2.1, most of the AL initiatives in EE Malaysia have been applied in specific programmes of study or courses, rather than institutions fully adopting the approach across the board. However, both institutions selected for this study have adopted AL approaches in all the programmes of study (Case Study 1 – in most of the course modules, and Case Study 2 – in the last two semesters in the industry) and are recognised by the Malaysian Qualification Agency (MQA). MQA utilise the Malaysian Qualification Framework (MQF) to develop and classify qualifications based on a predetermined set of criteria.

Both institutions are also chosen because their academic year suits the research timeframe. In addition, the geographical location of the case studies is taken into consideration during the selection process. It is necessary, for example, to be able to drive from one case study to the other in a reasonable amount of time when collecting the data. To avoid this type of logistical issue, the case studies selected are both situated in the same state in the Central Region of Malaysia, namely Selangor.

Whilst both sites adopt a similar learning ethos in that they use an active learning approach, each follows a slightly different variation of that approach. This enables the researcher to gain a holistic view of a certain phenomenon or series of events (Yin, 2003) and provides a real picture since multiple sources of evidence are used (Noor, 2008). Noor also claimed that case studies allow generalisations as the results of findings using multiple cases can lead to some form of replication (p.1603).

3. **Discipline and the Course Module Focused**

This study focuses on the Diploma/Higher Diploma level in Mechatronics/Bio-Medical Electronics (Malaysia) qualifications. Although it includes two different levels of achievement, the "capstone" of the learning is the main concern of the researcher to address the research question. Engineering is chosen because of the reasonably well-defined occupational destinations of engineering graduates, and the well-articulated expectations of employers in the engineering sector with well-established standards by professional associations (Tremblay et al., 2012). From an employment perspective, engineering creates critical demands on graduates' employability skills (Saad et al., 2013).

After discussion with the two programme coordinators, the Final Year Project module (in Case Study 1) and the Engineering Improvement module (in Case Study 2) are selected as the appropriate course module to study. Initially, the researcher is interested in a few modules; however, the coordinators advise that these course modules are crucial to students, as they apply fundamental discipline knowledge to projects that are used widely in the real workplace. In addition, these are the only modules that assess the three generic skills (problem-solving, verbal communication and teamwork) during the last semester when students are in the AL environment. Thus, an understanding of these course modules is critical to the researcher, in order to increase and contribute to his knowledge of the study context. Other course modules that use AL are shown in Appendix 10 (for Case Study 1) and Appendix 11 (for Case Study 2).

Purposive sample sizes are often determined on the basis of theoretical saturation, where a point in data collection is reached whereby no new data is being collected (Glaser, 1978). As such the use of theoretical sampling is seen as a necessity due to the inductive and deductive nature of the research (Kohlbacher, 2006). Theoretical sampling is a particular kind of purposive sampling in which the researcher samples incidents, participant or units on the basis of their potential contribution to the development and testing of theoretical constructs (Ritchie et al., 2003, p. 80). Overall, in qualitative research it is important to have sufficient data. Although there are no specific guidelines on how many participants are needed, it is commonly held for between 20 to 50 interviews to be undertaken before theoretical saturation is reached (Patton, 1990).

3.4.5 The Methods

There are two main methods used for the data collections:

1. Course documents
2. Semi-structured interviews

3.4.5.1 Course Documents

Blaxter et al. (2006) defined documents as (public or private, official or unofficial, statistics or words,) artificial and partial accounts, and which need to be critically assessed for research purposes. For both case studies, the course documents are the guidance in a written format for the students to motivate their learning. As the course documents may define the learning objectives, the intended learning outcomes, course contents, learning activities and the assessment approaches that are used during the programme, these documents are collected for this study. The researcher only focuses on the guidelines, that relate to skills of problem-solving, verbal communication and team working. Data, such as intended learning outcomes, learning activities, graduate attributes, assessment tasks and criteria, is collected from the documents. This data is then recorded in the curriculum alignment matrix as shown in Table 4-16 and Table 5-16 respectively.

The process is conducted to ensure the learning outcomes, learning and teaching approaches, and assessments are aligned in a documentation sense. As Biggs (1999b) suggested, the appropriate verbs should be embedded in the assessment tasks and the objectives, so that judgements can be made and presented. This method is utilised to answer partly the research question; (2) How is generic skills assessment implemented?

3.4.5.2 Semi-Structured Interviews

The second method of data collection in this research is semi-structured interviews along with personal observation and informal conversations (Yin, 2003). Interviews attempt to capture the understanding of the world from the participants' point of view; they seek to understand meaning and to uncover an individual's lived world and paradigm, prior to scientific explanation (Kvale, 2008). Robson (2011) described that in the semi-structured interview: "*The interviewer has an interview guide that serves as a checklist of topics to be covered and a default wording and order for the questions, and additional unplanned questions are asked to follow up on what the interviewee says*" (p. 280). According to Cresswell (2009), in semi-structured interviews, the form of questions have the advantage that they are both closed ended, that is, they are easy to make a comparison, and open ended, which gives space for the interviewee to answer within a wider structure.

Semi-structured interview techniques are chosen because of the limited time for the interview to be conducted. The approach helps the researcher to stay focused and aids further discussion regarding any interesting relevant points if they crop up during the interview (Robson, 2002). The researcher conducts face-to-face semi-structured interviews to obtain as much in-depth information and participant understanding as possible; and at the same time it is also, obviously, be recorded precisely and in an unbiased manner. Yin (2003) recommended that the questions of a semi-structured interview should be reviewed by experienced supervisors to check their alignment with research questions and objectives and to enable the reduction of bias during the process. Semi-structured interviews are widely used by researchers to obtain information and perceptions regarding key issues, and are also used to seek recommendations, specifically within generic skills perspective (for example, see Dahlmann et al., 2008; Jones, 2009; Jackling et al., 2010; Mitchell et al., 2011; Clark et al., 2012).

Before interview sessions start, respondents are asked if they are willing for the interviews to be digitally recorded as to maintain the ethical issues in the study. If not, the researcher takes notes during the interview. In addition, the researcher also notes expressions and words that may have useful meanings in the context of the issue being investigated. The recordings are used to transcribe the data. The interview framework is as shown in Table 3-2.

Table 3-2 Interview framework (Source: author)

Stage	Process
1.	a. Interviewing the respondent ←——→ Signature informed consent b. Background details
2.	c. Recording the interviews • MP3 recorder • Record interviews
3.	d. Transcribing • Listening to the recording • Translating the data • Noting from the recording • Reviewing the notes • Writing/typing the transcription • Respondents confirming the data
4.	e. Reading and coding • Reading and classifying verse/unit by theme using NVIVO software • Providing coding
5.	f. Analysing the data • Analysing by theme • Relating the theme to research questions
6.	g. Conclusions and reports

a) Student Interviews

The students' interviews are done to seek their perceptions on the active learning approach and generic skills assessment, specifically examining those appertaining to their interest, motivation, ability and participation. Student perceptions are stated to have a considerable influence on student learning (Struyven et al., 2005). The interviews are also designed to track students' understanding, practice and knowledge of generic skills assessment and provide the opportunity for students to reflect on the years' experiences being assessed by the lecturer. It is used to map whether or not the intended learning outcome, pedagogical approach and assessment have been achieved and completed throughout the module. The students are given an option either to answer in English or the Malay language, in order to capture the findings more explicitly and as it gives the students an increased confidence in their answers. The method is used to answer partly the research questions: (1) How is AL being implemented? (2) How is generic skills assessment implemented? (4) What are students' experiences of generic skills assessment?

b) Lecturer/Mentor Interviews

Lecturer/mentor interviews are all conducted in the institution's premises. The interviews allow lecturers/mentors to describe their own personal stories and past experiences of teaching in the AL environment and assessing students' generic skills. This provides insight into the lecturers'/mentors' overall understanding and practice of the generic skills assessment and their relationships with students and colleagues.

The interviews are aimed to capture a holistic picture of the lecturers'/mentors' perceptions of their practices in assessment and their relationships to their students. It also includes the lecturers'/mentors' reflections on experiences over the past year regarding students' results and achievements. Their reflections on what they have done in the past, how it leads to what they are doing now and possibly how they want to assess generic skills differently in the future are some of the main aims of the interview outcomes. Similarly, to the students' interviews, the lecturers/mentors also need to justify whether or not the intended learning outcomes, pedagogical approaches and assessments are aligned to the curriculum. The method is used to partly answer the research questions: (1) How is AL being implemented? (2) How is generic skills assessment implemented? (3) What are the lecturers'/mentors' experiences of generic skills assessment?

c) Employer Interviews

Selected employers are interviewed, depending on their profile within the case-studies. The aim is to find out the employers' satisfaction/dissatisfaction with the graduates; problems they face when recruiting potential employees, specifically with regards to generic skills; and up-to-date required attributes in graduates for the current technologies and working environments. A clearer understanding of essential generic skills and professional attributes is important as it is needed in the workplace (Shah et al., 2011; Rosenberg et al., 2012). The aim is also to investigate the mismatch in what students expect to learn in Higher Education institutions, what they need to know, and what they should be able to do in the workplace (Mai, 2012). The method is used to answer the research question: (5) What generic skills attributes do employers expect engineering graduates to possess?

3.4.6 Data Analysis Approach

Qualitative data analysis involves systematically searching and arranging the collected data through various methods within a study (Bogdan et al., 1998). According to Blaxter et al. (2006), the problem in qualitative data analysis is that it is accomplished mainly with words, not numbers as it usually embodies multiple meanings. It is important for the researcher to realise that there are multiple alternatives and practices to analyse social events, especially in qualitative data analysis. There is no single way or methodological framework well formulated to analyse qualitative data (Punch, 2005). According to Cresswell (2009), data collected through various methods, including interviews, observation and course documents, should be brought together by bringing some meaningful description, or in a summary form, and later by highlighting significant findings. He further suggested to store and organise the summarised data in a personal computer and back this up in digital media for analysis and descriptive writing.

Miles et al. (1994) suggested for the researcher to code the data and count codes to identify the frequency of similar codes appearing in the database. According to Zhang et al. (2009), this approach seems quantitative in the early stages, but the objective is to explore the usage of keywords in an inductive manner. Coding involves the process of data dissecting and providing labels to units of meaning, which helps the researcher to pool ideas, to cluster and later draw conclusions (Hurworth, 1996). Hsieh et al. (2005) described the process as: *"A research method for the subjective interpretation of the content of the data through systematic classification process of coding and identifying themes or patterns"* (p. 1278).

The literature suggested the use of computer software applications, for example, NVIVO, which is a systematic way to code the data, categorise codes and identify themes (Bazeley et al., 2013). For this research study, the researcher employs Wolcott (1994) three steps of data analysis: description, analysis and interpretation.

3.4.6.1 Description

The description is the initial phase of data analysis in this study. Activities include transcribing the audio, summarising field notes and integrating these with the course documents. This phase begins with transcribing the audio. The audio data is transcribed soon after it is collected. The process of collecting the data takes four months to complete, and it is fully transcribed nine months after collection.

The researcher utilises Microsoft Windows Media Player 10 for transcribing the audio-recorded interview. As English is not the researcher's first language, the researcher requires approximately six hours to transcribe the 30 minutes of audio-recorded data. Examples of the audio transcript are presented in Appendix 2.

Miles et al. (1994) suggested using memos to help to tie together pieces of data into an identifiable cluster which later may create the general concept. Thus, the researcher takes the suggestion to combine ideas that emerge from the audio transcript of interviews and course documents. The initial emerging findings are sketched on paper using simple diagrams and tables to make it significant.

3.4.6.2 Analysis

The purpose of this phase is to reduce the pool of data. This phase is conducted in a two-stage process. The first stage involves coding and categorising, while the second stage consists of writing narratives of the participants' (students', lecturers'/mentors' and employers') experiences. The narratives of the participants are presented in both case studies in Chapter 4 and Chapter 5.

3.4.6.2.1 Coding and Categorising

Coding is a tedious process, during which patterns and themes are identified to represent the significance and meaningfulness in data (Patton, 2002). Hurworth (1996) described that computer-aided analysis helps to cut out most of the drudgery, provides systematic organisation of data, offers flexibility and permits complex testing of ideas. Thus, after careful consideration of the pros and cons of utilising computer-aided analysis, it is decided to use NVIVO software application for managing the sources, coding and clustering the interview data. It was claimed by the NVIVO developer that the software provides researchers with a set of tools to manage data, manage ideas, query data and transform it into a graphical model.

The researcher employs Miles et al. (1994) bottom-up and the top-down coding approaches for coding interview data for this study. Bottom-up coding involves coding the data from scratch using key ideas that emerge from the data. On the other hand, top-down coding involves using ideas from the literature and codes that are developed during the bottom-up coding process.

Initially, a few interviews are manually coded using the bottom-up approach. The codes that emerge during the manual coding are used to code the rest of the data by using NVIVO software. However, the researcher does not limit the analysis to the initial coding, in case new themes or coding emerge from the data, revisions and refinements are needed.

Figure 3-4 shows the NVIVO project file that is used for analysis of the data collected for this study. On the left-hand side of the figure (navigation view), the sources of the data for both case studies, such as course documents and semi-structured interviews, are displayed. The highlighted item “PBL_Students” is elaborated in the main section of the figure (list view), which indicates the total number of codes present in each student’s interview and the total number of references made to those codes. The audio and transcript files for the students’ interviews are also displayed. In addition, the date of creation and the date of modification appear in the list view.

Figure 3-5 illustrates some of the sample codes and categories that emerge during the coding process. The NVIVO software provides detailed information on the number of times a particular code for different sources are used and the total number of references referring to all the sources. Referring to Figure 3-5, the codes that correspond to the categories of the lecturers’ PBL processes are presented. A blue rectangular box highlights the code “Reflection”. This code summarises the last stage of information from the PBL process, where the lecturer has given students something on which to reflect; it verifies the information, reflecting on the learning outcome and summarising the learning. This code is established from five different sources and is referenced eight times in those five sources.

3.4.6.2.2 Narratives

At this stage of analysis, the process starts by obtaining feedback on initial ideas and making metaphors. As the researcher has adopted a multiple case study approach in this study, it is worth noting Miles et al. (1994) argument: that the meaning of the data collected from individual interviewees tends to get lost during the process of coding. Further, Miles et al. (1994) recommended employing case analysis meetings, in order to combat this problem. Therefore, the researcher meets his supervisor once a month for at least one hour to summarise the current status for each group of participants. Each of the questions raised during the meeting reflects the researcher’s way of thinking and helps refine the findings.

The narratives of the participants (students, lecturers and employers) for both case studies are presented in Chapter 4 and Chapter 5 respectively. Although the narratives give an account of what the students and lecturers have experienced in HE concerning the assessment of generic skills, it is necessary to understand the implementation of active learning settings to gain a broader sense of their learning and teaching. Besides, it is also important to distinguish the graduates’ performance of their generic skills from the employers’ perspectives. Therefore, it is necessary to proceed to the last stage of analysis: interpretation.

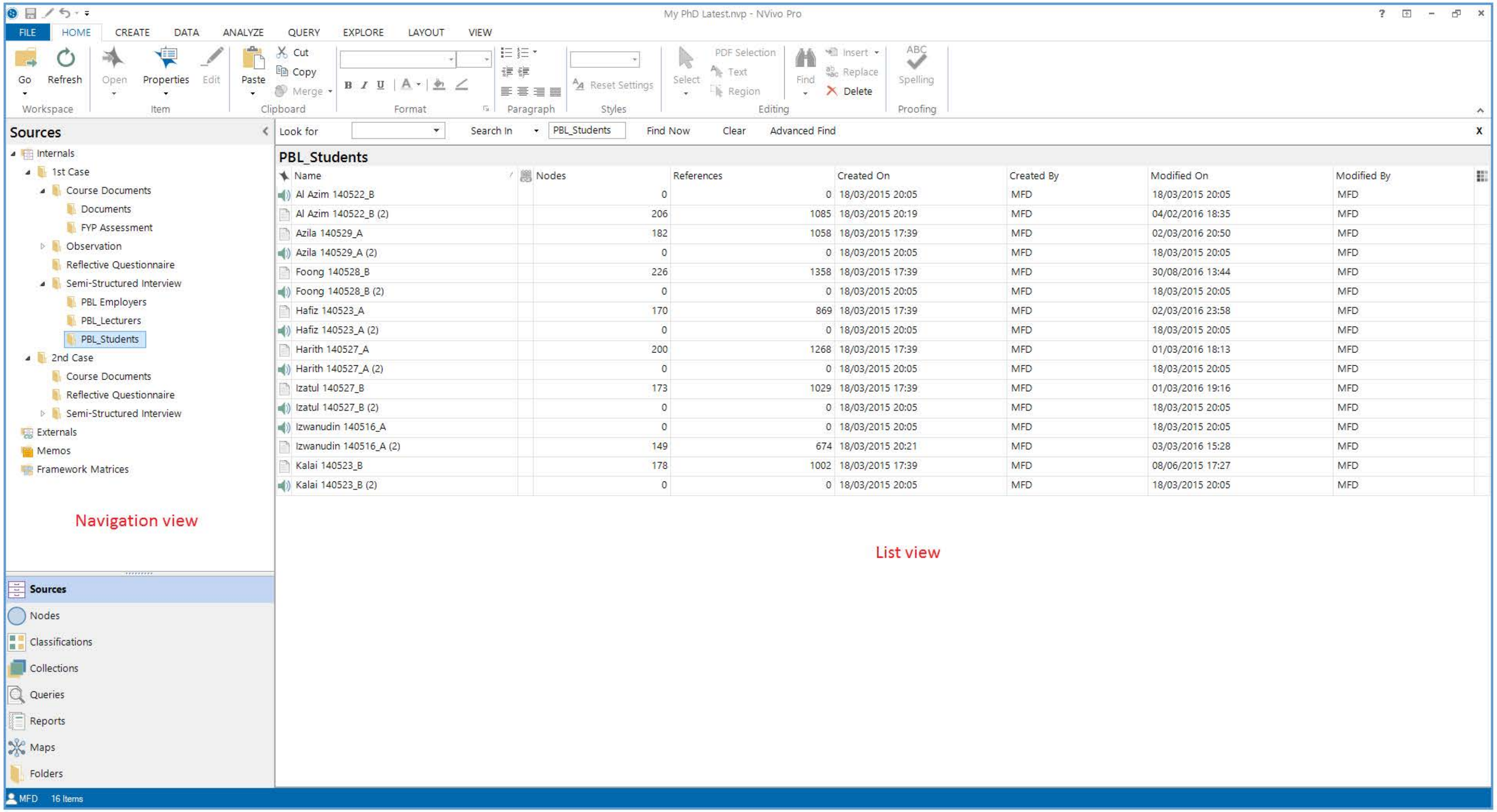

Figure 3-4 NVIVO project window showing sources of data (Source: author)

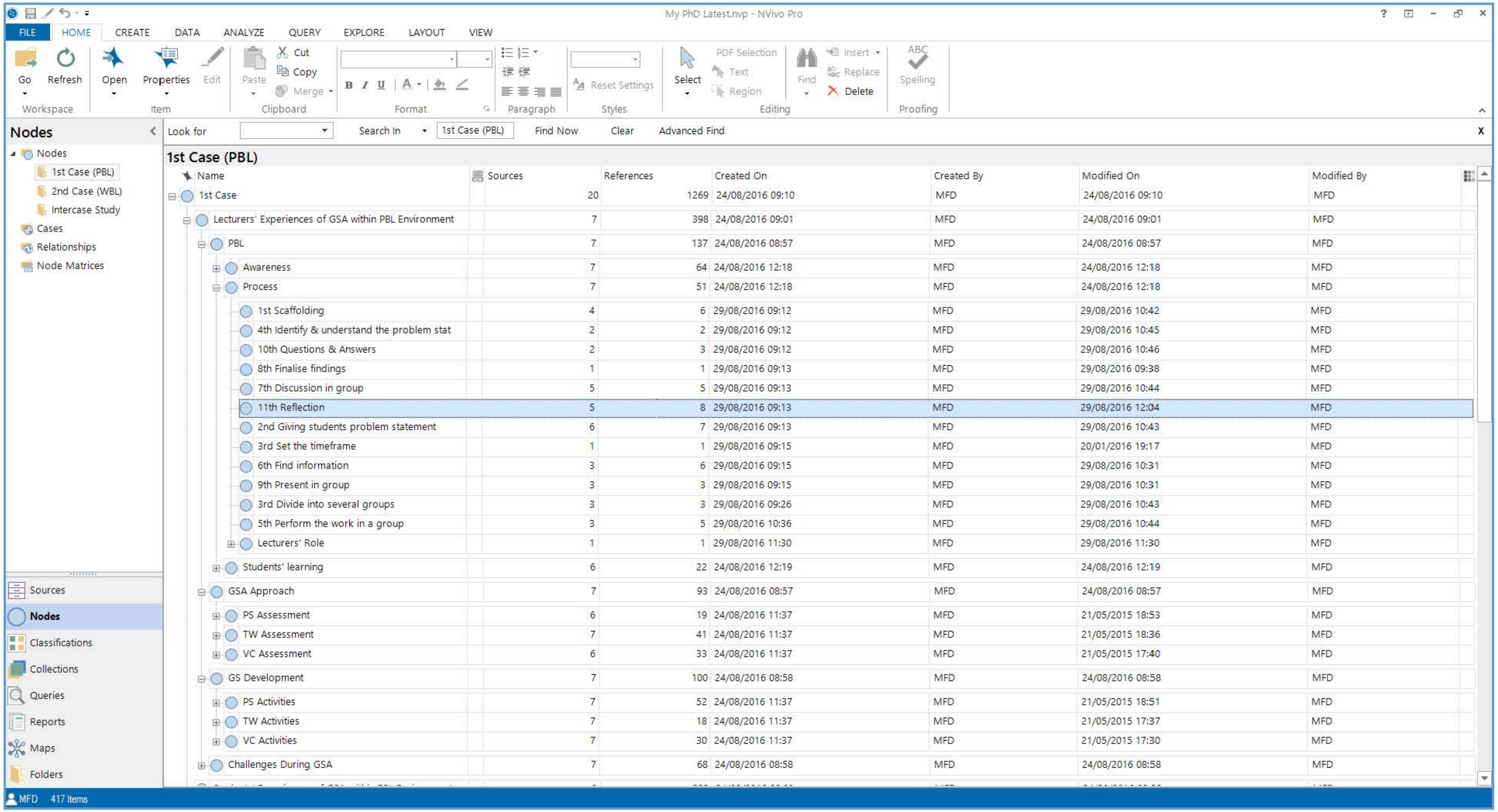

Figure 3-5 NVIVO project window showing codes and categories (Source: author)

3.4.6.3 Interpretation

The final stage of data analysis involves activities to check and refine the codes and categories. By systematically identifying similarities and differences across cases, Miles et al. (1994) described cross-case analysis as allowing the researcher to identify negative cases to enhance a theory, improve generalisability or apply to other similar settings.

Therefore, in this study, the cross-case analysis is used to compare and analyse similar patterns that emerge during both case studies. The patterns which emerge during the cross-case analysis are analysed with particular reference to the research question of interest. In particular, the cross-case analysis is used to identify patterns while developing the generic skills with its assessment. These patterns are then used in understanding the practice of the assessments that emerge from 16 students and 14 lecturers. Similarly, patterns from ten employers help the researcher to identify and update the attributes that represent the intended generic skills gained in HE.

Miles et al. (1994) recommended displaying data in the final report. The display can be generated by hand or even by using a computer program, either of which may help to organise data and motivate thinking (Hurworth, 1996). Hsieh et al. (2005), for instance, suggested that a tree diagram may organise the categories into a hierarchical structure. Figure 4-2 and Figure 4-7 presented in Chapter 4 are examples of diagrams that are generated during this phase of analysis. The key ideas that emerge during this phase of analysis are used as the basis for the researcher's ongoing discussion of his findings in Chapter 7.

3.5 Issues of Validity and Reliability

The issues of validity and reliability refer to the audit of the research. Validity is the degree to which research outcomes accurately reflect the settings of the study (Babbie, 1998). Validity is used to ensure that the methods represent the factors that are identified through the literature, and later emphasised in the research objectives (De Vaus, 2001). Greenfield (2002) considered any research to be valid when it measures what it is supposed to measure.

Reliability is demonstrating the process of a study – such as data collection procedures, keeping records and repetitions with the same results (Yin, 2014). In other words, Gay et al. (2009) described the degree to which a test consistently measures the attribute it is measuring (p. 158). Four tests are commonly taken to establish the quality of empirical social science research. Yin (2014) stated that, among these tests, only internal validity is not relevant to case study research as it seeks to establish a causal relationship. The others are 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. 46).

The testing of the construct and external validity, and reliability of this research are discussed next. Yin (2014) and Cresswell (2012) explained that construct validity could be increased through multiple sources of evidence, establishing a chain of evidence and then having the draft case study report reviewed by key informants. In the context of this study, the multiple sources of evidence include the pilot study, semi-structured interviews and the course documents which are used to form the chain of evidence. This process forms the construct validity.

Similar to Yin's explanation, Trochim (2000) described external validity as the degree to which the outcome of the research study holds for other persons in other places and at other times. The issue, previously discussed in Chapter 3.4.2, is to produce generalisable results in a case study, either by conceptualising or by developing hypotheses. As this study conceptualises generic skills assessment within AL environments in Malaysian HE with the aim of improving the standardisation and reliability of generic skills assessments in HE institutions, this provides the basis for external validity.

Finally, the goal of reliability is to minimise the errors and biases in the research. Reliability in social science can be divided into two types: internal reliability and external reliability. This study referred to Drew et al. (1996) proposals to maintain reliability in qualitative research. The proposal includes the sets of steps as follows:

For internal reliability:

1. Use low inference descriptors.
2. Use multiple researchers when possible.
3. Establish a careful audit trail (record procedures on collecting and handling the data that can be followed by another researcher until the conclusion has been made).
4. Use mechanical recording devices where possible (and with permission).
5. Use participants as researchers or informants to check the accuracy or congruence of perceptions.

For external reliability:

1. Clearly specify the researcher's status or position so that readers know exactly what point of view drives the data collection.
2. Clearly state who the informants are (or what role they play in the natural context) and how and why they are selected (while maintaining confidentiality).
3. Carefully delineate the context or setting of boundaries and characteristics so that the reader can make judgements about similar circumstances and settings.
4. Define the analytic constructs that guide the study (describing specific conceptual frameworks used in the design and deductive analysis).
5. Specify the data collection and analysis procedures meticulously.

Based on these steps, this study plans to maintain all points in the internal and external validity, as suggested. Consequently, the reliability of this research is achieved.

3.5.1 Triangulation

A massive quantity of data is produced as multiple methods of collection are adopted. This is to ensure that the issue of generic skills assessment within the AL environment is not explored through one lens, but rather a variety of lenses which allows for multiple facets of the phenomenon to be revealed and understood. Therefore, it is necessary to have a systematic organisation of the data to avoid data overload or perhaps data overload or confusion, which may cause the researcher to lose sight of the original research objectives. To avoid both circumstances, Table 3-3 shows how multiple methods and instruments may apply to this study. This process makes it easier to triangulate the data. Brewerton et al. (2001) described triangulation as the use of different research sources to collect data from alternative sources within the same study to assess the validity of the findings (p. 200). Triangulation allows researchers to create an appropriate framework for the phenomenon being studied especially when it involves studying the structure, development and changes in the setting. In the context of this study, the literature review, semi-structured interviews and course documents data helps to overcome issues of reliability and validity (Brewerton et al., 2001).

Table 3-3 Data collection methods and their purposes (Source: author)

No.	Method(s)	Objective
1.	Literature review and semi-structured interviews	To critique the existing methods of assessing generic skills in the context of Engineering Education within an AL environment based on the literature.

2.	Course documents and semi-structured interviews	To collect data from two case study institutions in a range of different forms that would then allow integration with the literature. To develop a framework to guide the assessment of generic skills in an AL environment.

3.6 Ethical Issues

Ethics refers to questions, both good and bad, and considers how the research purposes, contents, methods, reporting schemas and outcomes abide by ethical principles and practices (Cohen et al., 2007, p. 51). Ethics in this study also associates with ethical guidelines laid down by Aston University (AU), the Government of Malaysia and the gaining of ethical approval from academic bodies, before the start of data collection. The first step is to submit this research proposal to AU's Research and Committee members. The application is important to make sure the researcher understands and follows the ethical policies of the appropriate institutions.

According to Wiersma (1997), if research is conducted in an educational setting, it is compulsory to attain permission from the approving agency body. Hence, to collect data in Malaysia, official permission is sought and is granted by the Malaysian Ministry of Higher Education and the Malaysian Economic Planning Unit (EPU). An official form is submitted together with the ethical approval from AU, along with the research proposal, a sample of interview questions and schedules, and also observation schedules. Also, it includes the procedures for obtaining consent and access to the institution proposed for inclusion in this study. Once approval is obtained, the approval letter is sent to the director/dean of each intended institution to ask for permission to conduct the study.

A copy of the letter is also sent to the lecturer and Head of Department/Section of Mechatronics/Bio-Medical Electronics in both institutions, and access is then negotiated. They are informed of the nature of the research and the conditions in which it is intended to be conducted. They are also invited to discuss and post questions regarding the research before it starts. Any and all suggestions are considered and appreciated at this point.

The research is also guided by the British Research Association code of conduct (BERA, 2011) for education researchers. There are five relevant ethical principles that are observed throughout the research. They are:

i. Respect for the person
ii. Voluntary informed consent
iii. Avoiding detriment arising from participation in the research

iv. Full disclosure certification and other safety considerations
v. Data protection

i. Respect for the Person

The universities and institutions, as individual case study sites are considered to be “persons”, and like all participants, are treated with respect. Each organisation is afforded the general ethical principles of social research, reflected in the design of the study, and is informed of the way the data is gathered and disseminated. The researcher updates the management throughout the research process and informs them of any issues that occur or changes that are made. During the fieldwork, college cultures, dress code and other rules are complied with and any “difficult periods” are acknowledged and respected.

The lecturers/mentors might present some challenging ethical dilemmas to the inquiry. However, a balance is kept between the researcher’s respect for the lecturers and respect for the university/institution. If lecturers/mentors bring personal problems to the interviews, an effort is made to discourage the lecturer/mentor from this, while maintaining the relationship that has been built up.

The students, because of their age and vulnerability, visibly high levels of respect are given to them, as is stated in the research outlines and statements of ethical considerations supplied to every university/institution. All students in the study are referred as “final year students”, which is part of the criteria for participation in the research. Selection are made independently of any student's learning needs, gender, ethnicity or religion and this forms part of the research.

As with the lecturers, students might bring personal issues from the class to the interview. During transcriptions, any such data is omitted. If students use swear words during the interviews, the situation is not encouraged, but neither it is forcefully discouraged. The researcher is aware that this language can sometimes be a cultural aspect of the participating individual or group and that the research is of a “real world” nature. It is, therefore, noted in the transcripts of recorded data.

ii. Voluntary Informed Consent

Voluntary informed consent is sought from every research participant. Each is given a letter introducing the researcher, explaining the research, and guaranteeing anonymity in reporting and confidentiality on their responses. The researcher clearly emphasises that participation in the research is voluntary and that participants have the right to withdraw at any time during the study. The letter also states that any data collected will be stored securely and be destroyed after the end of the dissertation period (within five years from the date of publication) and that personal data can be obtained only on request to the researcher and only to the individual. The letters given out to students are different to those given to the lecturers/mentors. The consent forms are signed and dated by both parties (researcher and participant), with a copy given on request. If the participants do not want to print their name on the form, a signature and date suffice. Before conducting the interviews, where required, the main features of the research are repeated and the implications for their involvement restated.

iii. Detriment Arising from Participation in the Research

A reflective log is used to keeps a note of any incidents that might occur as a result of the researcher's fieldwork activities, particularly during the interviews, where relationships between the researcher and the participants are established to gain the data required for the study. Regular assessments of the situation, at regular intervals, ensure no detriment is caused to any parties involved in the research project. The research designs do not disadvantage one group of participants over another or one individual participant over another.

The lecturer/mentor

If any lecturer/mentor from any of the two participating institutions withdraws from the research or refuses to be interviewed or observed for fear of detriment or for any other reason, the data is not disclosed to the management, other lecturers/mentors or any students.

The students

The student participants are selected from various groups of individuals in their Final Year Project course. They are selected for their differences from others in the group, and they are not given a special advantage. As with the lecturers, the students' identity or comments are not disclosed to lecturers or other students.

iv. Full Disclosure Certification and Other Safety Considerations

A copy of a Full Disclosure Certificate is given to the management in each university/institution and held on file. A copy is carried at all times when conducting the fieldwork and shown to all interviewees before an interview. At no time during the study is the researcher permitted to be alone with any student, either male or female. All contact is made in public areas or within a classroom setting with other students present. University/institution identity cards are visibly worn at all times while on university/institution premises, the visitors' book signed accordingly, and health and safety information adhered to.

v. Data Protection

All information gathered during the research is kept strictly confidential by the researcher. None of the reports or publications from this study includes any information identifiable to the participant as an individual.

The interviews and observations are recorded on a digital audio/video recorder which is then uploaded to a password-protected computer at Aston University. The digital audio/video recording is deleted from the recording devices. All documents are kept in a locked cabinet on secure premises following the Data Protection Act. All data can be kept for up to five years after which it will be destroyed securely. Electronic copies of the transcripts are stored securely and confidentially: access to these are limited to the researcher and his doctoral supervisors and is password protected.

3.7 Summary

To summarise, the research questions and research methodology are used to investigate generic skills assessments within an active learning environment in Malaysian HE, focusing on the engineering discipline. The qualitative methodology employed in this study is designed to capture and theorise assessment practice within active learning settings, particularly from students' and lecturers'/mentors' perspectives. Their experiences of the development and assessment of generic skills benefits the researcher in understanding the nature of generic skills assessment. Similarly, the study explores the generic skills attributes of problem-solving, verbal communication and team working by analysing data from employers. Data collection methods include semi-structured interviews and course documents. The approach of data analysis is also presented in this chapter. In the following chapter, information about the participants and research findings is presented.

4 Case Study 1: Generic Skills Assessment (GSA) within a Problem-Based Learning (PBL) Environment

4.1 Introduction

This chapter focuses on three groups of participants in one of Malaysia's HE institutions. The chapter further elaborates on engineering lecturers' and students' experiences of generic skills assessment, and employers' experiences of engineering graduates' generic skills and attributes. The discussion is formed based on the findings from semi-structured interviews and course documents. Firstly, this chapter presents the current implementations and the engineering lecturers' obstacles when assessing students' generic skills within one of the active learning environments – PBL. This data also presents the lecturers' reflections on their careers, teaching approaches and their current and previous generic skills assessment practices in a classroom learning session.

Secondly, data collected from the students' interviews provides helpful, basic information about the students' perceptions of generic skills assessments, the developments it leads to and the regular learning and teaching practices carried out by their lecturers. This data is supported by findings provided by lecturers in their interviews, in which they reflect on their approach to teaching and evaluate their students' generic skills. The data from the interviews is very helpful to further understand the lecturers' expectations and students' academic performance respectively.

Furthermore, the findings from the employers' interviews represent industry's reflections on current graduates' generic skills performance and the expectation of generic skills attributes for future graduates after HE learning. The findings from the three perspectives: lecturers', students' and employers are important, in terms of triangulation. Any differences of agreement between both lecturers and students (in HE practice) with industry expectations of generic skills attributes are discussed further in the conclusion chapter. The research framework of the first case study is presented as shown in Figure 4-1. The stages shown in the figure are determined and used as a basis for the researcher's ongoing discussion of his findings and analysis. The analysis and discussion later contributes to answer the objective of this research study: to critique the existing methods of assessing generic skills within an AL environment in the Malaysian Higher Education institutions. This is then used as a basis to develop the generic skills assessment framework.

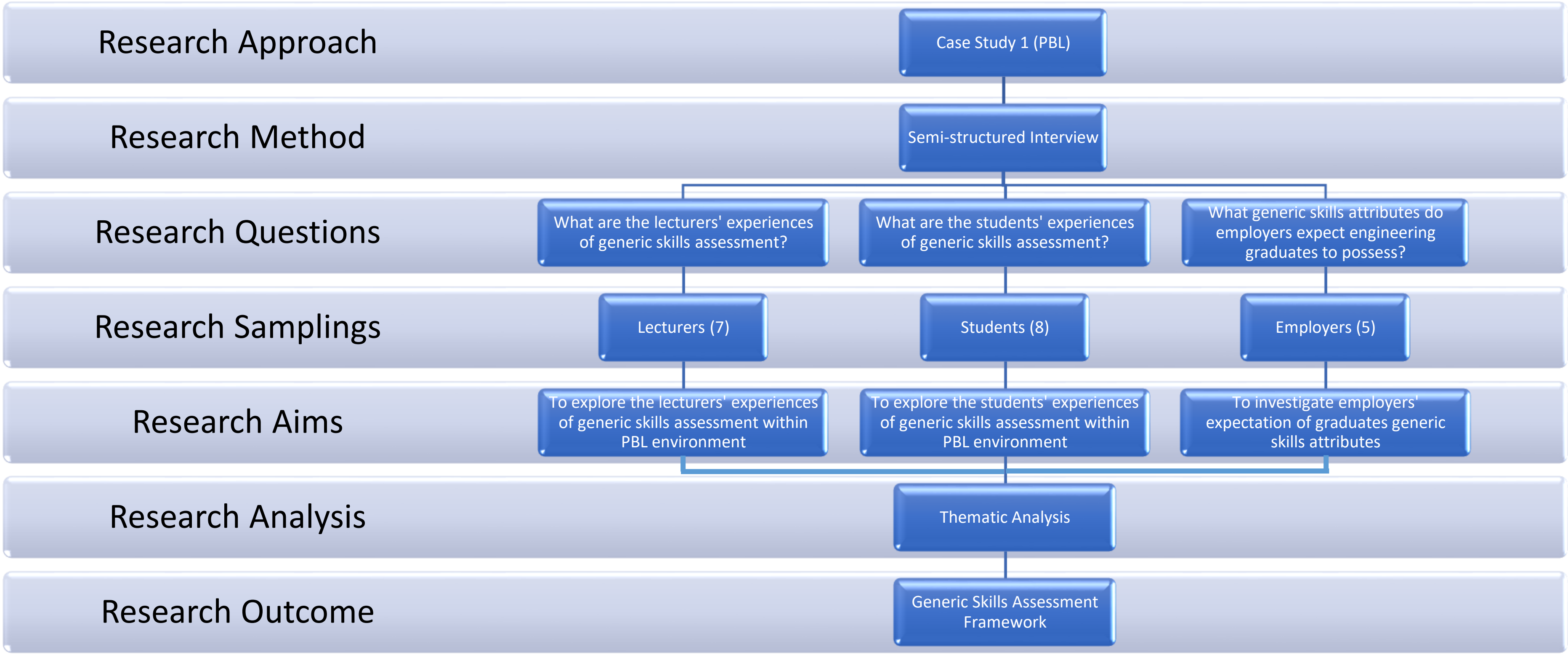

Figure 4-1 Research framework – Case Study 1 (Source: author)

4.2 Findings of Lecturers' Experiences of GSA within PBL Environment

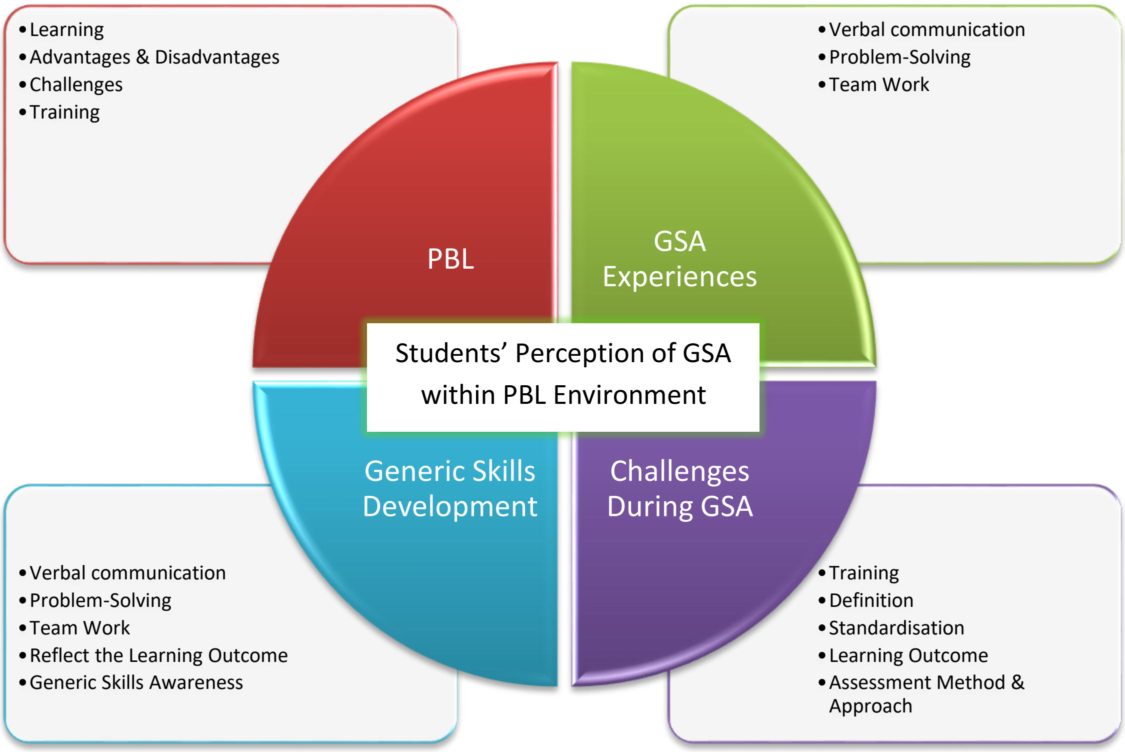

Figure 4-2 A Summary of the lecturers' experiences of GSA within a PBL environment, main themes (Source: author)

Seven Mechatronics Engineering lecturers were selected, with recognised teaching qualifications and experience in assessing generic skills are selected to take part in the research. Characteristics such as gender, rank, number of years working in industry and teaching experience, are also considered. These criteria are critically important to provide as wide a variation in reflections and experiences as possible (Flynn et al., 2004, pp. 16-17).

Semi-structured interviews are conducted with the aim of capturing a holistic picture of the lecturers' experience of their practices in generic skills assessment. The interviews also include the lecturers' reflections on their experiences over the past year regarding the students' results and achievements. The lecturers' reflections on what they have done in the past, how it has led to what they are doing now and how they want to assess generic skills in the future are among the main aims of the interview outcomes. The lecturers are also asked to justify whether or not the intended learning outcomes, pedagogical approaches and assessments are in line with the demands of the curricula and of industry requirements. The interviews are transcribed, then categorised with a range of synonyms and words associated with keywords. Four keywords (themes) are created from the scripts as shown in Figure 4-2: PBL, generic skills development and assessment, and its challenges.

4.2.1 Lecturers’ Background

In this section (see Table 4-1) the lecturers’ brief biographies are presented. The information presented is authentic, pseudonyms are utilized to enhance confidentiality. All the names are created for the participants but only recognized by the researcher. The code for each participant is made up as follows:

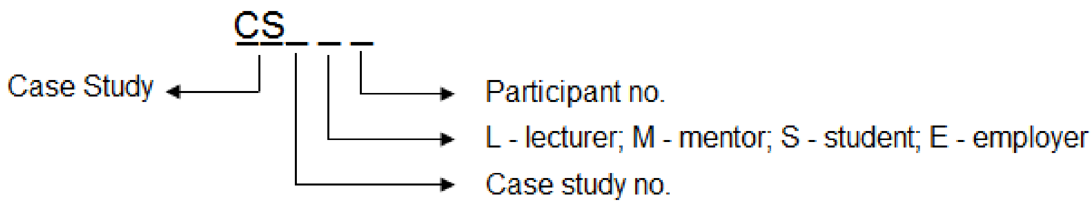

Figure 4-3 Code for each participant (Source: author)

As is shown in Table 4-1, out of the seven respondents, only one is a female, named CS1L2. Further information on the participants’ profiles is presented in Figure 4-4, Figure 4-5 and Figure 4-6, respectively.

Table 4-1 Lecturers’ biographical background (Source: author)

Participant	Biographical Background
Case Study 1	
1. CS1L1	A 33-year-old male lecturer who is a Master’s holder in Electrical Engineering from a local university. He joined this institute in 2009. He has 5 years of teaching experience and 2 years of industry experience.
2. CS1L2	She is a 36-year-old. She started teaching in this institute in 2011 and holds Master’s degree in Electrical Engineering. She has 4 years’ teaching experience and 2 years of experience in industry.
3. CS1L3	A 31-year-old male lecturer. He has a Master’s degree in Mechanical Engineering and 4 years’ teaching experience. After 3 years’ experience in the industry, he joined this institute in 2010.
4. CS1L4	A 34-year-old male senior lecturer, holding a Master’s degree in Mechatronics Engineering. He began to work in this institute in 2007, has 7 years’ teaching experience and 3 years’ experience in industry.
5. CS1L5	He is a 33-year-old male senior lecturer. He recently gained a Master’s degree in Mechatronics Engineering, has 5 years’ teaching experience with 3 years’ industry experience. He started teaching in this institute in 2009.
6. CS1L6	A 44-year old male senior lecturer with a Master’s degree in Mechatronics Engineering from a local university. He started his career as a lecturer in 2004 after 1 year of experience in industry.
7. CS1L7	He is a 41-year-old male lecturer. He joined this institute as a lecturer in 2010 with a degree qualification. He has recently graduated with a

	Master's degree in Mechatronics Engineering. Before he joined this institute, he worked for 13 years in industry.

Note: The year in which data is collected is 2014

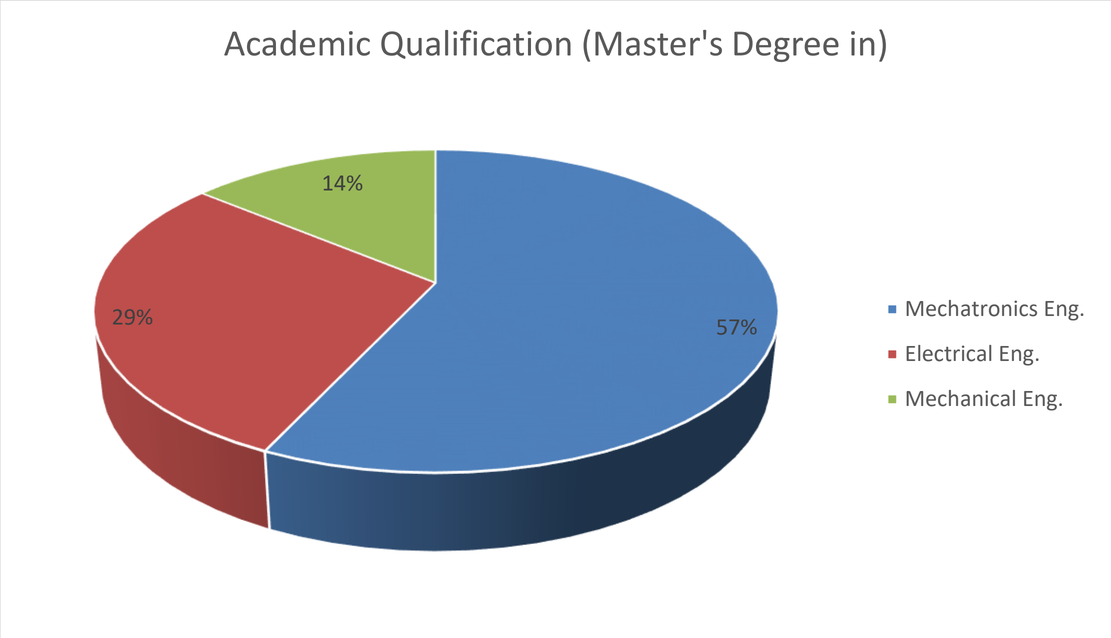

Figure 4-4 Lecturers' academic qualifications (Source: author)

From the interview scripts, the lecturers who participated in the study have different background qualifications. However, all of them hold master's degrees, as can be seen in Figure 4-4, with the majority holding a Master's in Mechatronics Engineering (57%).

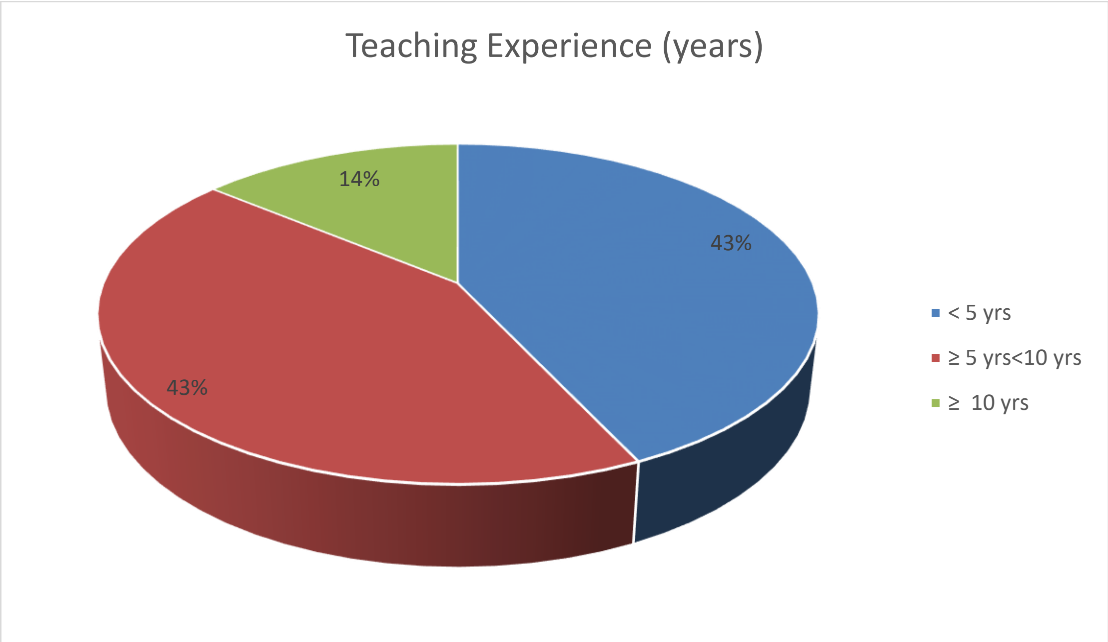

Figure 4-5 Lecturers' experience in teaching (Source: author)

As displayed in Figure 4-5, only one lecturer has more than ten years of teaching experience (14%), while three lecturers have taught for less than five years (43%) which explains the hands-on experience they have acquired over the years. This result clearly indicates that the lecturers are qualified and experienced in their profession.

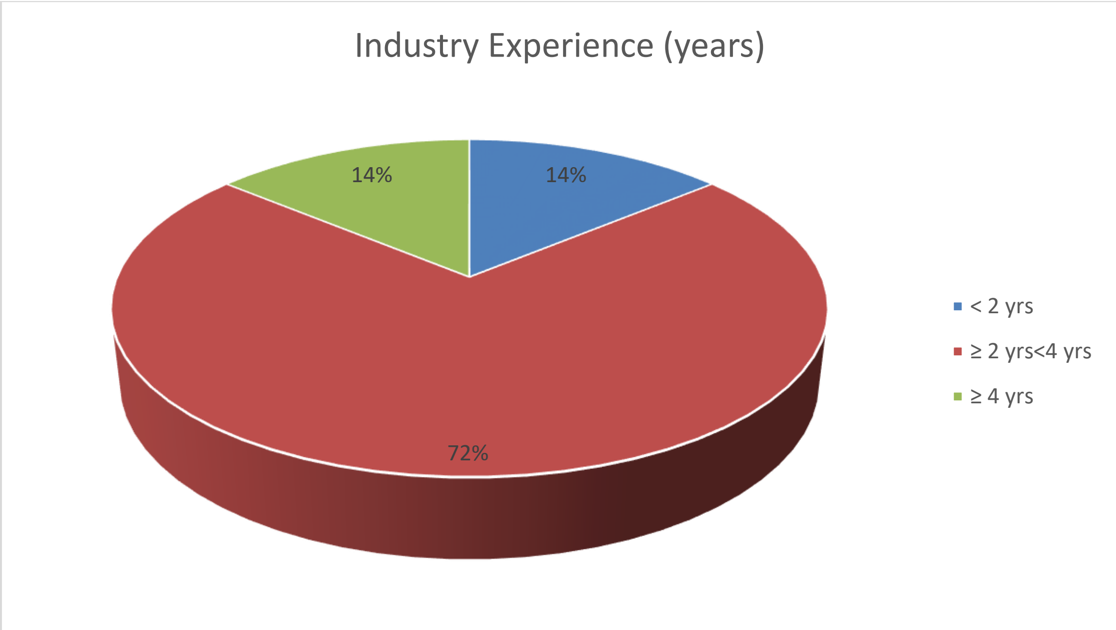

Figure 4-6 Lecturers' experience in industry (Source: author)

Figure 4-6 shows that most of the lecturers have between two to four years' experience in industry (72%). Their industry experience might provide the lecturers a broader perspective of relevant issues which they are then able to share in the learning and teaching environment. Sharing industry experience in the class is important as an early exposure for students to the real working environment. Experience of industry – might also be very helpful in assisting lecturers with their teaching and students' learning. One of the participants, CS1L1, describes how he has benefitted from industry experience:

> *"It is not so difficult when you are transferring from industry to this institute since it committed to producing industry players. The students produced by this institute have work experiences as such one undergoes in a real industry environment. I have a background in technical and I am teaching the same discipline here. Therefore, I can relate my previous working experiences with those technical subjects." CS1L1 (5 years of teaching experience, 2 years of industry experience)*

To explore further their feelings about teaching and their passion for being lecturers in this institute, lecturers are asked the following question: *"Why did you wish to join education after being an engineer in industry?"* The majority of the lecturers respond that they decided to move into the education sector after being in industry because they wanted to share their knowledge and experience with students. CS1L2, CS1L3, CS1L4 and CS1L5 believe, to become an academic, it is important to have technical experience to help with teaching. It is better practice to teach in an area of expertise and provides a positive contribution to their way of conducting classes because they are operating in a more familiar territory. This is because an effective lecturer is someone who can relate the lecture's content to the students' prior knowledge then link it to real-life examples; thus making knowledge more meaningful (Starks et al., 2007; Duffy et al., 2010). The lecturers' responses suggest that there are positive reasons for engaging those that have previously worked in industry to teach in HE.

Some of the lecturers give additional answers to the question of moving from industry to education. CS1L4 feels that working in industry was too pressurised and he didn't have enough time for himself. CS1L5 suggests that he had no opportunity to apply what he learnt during his years at university, which led to his lack of technical skills development. Other factors, such as the opportunities to further studies and a brighter career development, had motivated CS1L1. For others, such as CS1L2, CS1L6 and CS1L7, it has been their ambition since childhood to join the education community. Furthermore, when asked about the preference between a career as an engineer and a career in teaching, most of the lecturers generally choose teaching.

The passion, knowledge and commitment that lecturers have may significantly encourage the students' learning development while in Higher Education (Martínez-Mediano et al., 2012). This passion that the lecturers possess can be passed on to the students thereby, making sure that both educator and learner continue to progress.

4.2.2 Lecturers' Teaching Practices within PBL

This section focuses on lecturers' reflections to the question: "How is PBL implemented in this institute?" This is to investigate the lecturers' experience and to confirm their approach towards PBL practice within the institute. Similar to the previous section, the interviews are transcribed, then categorised with a range of synonyms and words associated with keywords. Three keywords (categories) are extracted from the scripts: **PBL awareness, PBL process** and **students' learning** in PBL. Figure 4-2 overleaf outlines the words which are associated with the themes that are transcribed from the interview. According to the lecturers, these three factors explain the PBL practice in this institute. This is discussed in detail in the appropriate section that follows.

a. PBL Awareness

From the lecturers' interview transcripts, it is shown that some lecturers are reluctant to change to the new approach (PBL). CS1L3, for example gives his statement as below:

"It is common in any organisation, for resistance to be present in the face of change." CS1L3 (4 years of teaching experience, 3 years of industry experience)

Most of the lecturers claim they have little understanding about PBL.

".. But frankly I have very limited knowledge of the PBL." CS1L5 (5 years of teaching experience, 3 years of industry experience)

"Until now I still don't really know the objective of using PBL... The trainer just provides us with one or two sheets of paper and then expects us to do further research by ourselves." CS1L4 (7 years of teaching experience, 3 years of industry experience)

Furthermore, only one day of training is provided by the institute to inform lecturers of PBL. The following aspects are tackled in training: a general view of PBL, a problem statement construction, a demonstration of PBL, problem-solving approach, and a consideration of appropriate tools that can be used in the classroom. According to CS1L2 and CS1L6, training only focuses on the general subject and there is nothing relating to engineering examples. All of the lecturers claim that information provided in order to implement PBL is not clearly delivered, that the training is insufficient and it does not help them in further understanding the application of PBL. They have to do extra work and their own research to increase their knowledge. As a result, each of the lecturers has a different interpretation of PBL's definition and practice.

"When I asked one of the facilitators regarding PBL, she answered differently to the other facilitator. When I asked the senior lecturers, the answer was also different from the other seniors so I have to draw my own conclusion. Frankly it is hard for me to accept something that I am not so sure about." CS1L7 (4 years of teaching experience, 13 years of industry experience)

CS1L1 agrees and adds that different interpretation have occurred because of the absence of proper guidelines, manuals and reading materials, which should have been provided to lecturers to ensure the standardisation of PBL practice across the institute. CS1L7 further adds that he would prefer to have permanent guidelines, which cannot be changed, in order to sustain the standardisation of the practice.

Unlike structured pedagogic training, where at the end of the training, the lecturers need to undergo an assessment (micro-teaching) to reflect their understanding and practice of teaching, the same cannot be said for PBL training. No training, or evaluation, is taken to find out, whether or not lecturers are competent to run PBL classes. In addition, there is no monitoring of lecturers' PBL implementation and the institute has not at this point consulted students for their opinions on PBL.

"Currently I think there is no quantitative research in terms of recording data or feedback from students on the full cycle of PBL so I think we have to go through a full cycle before we can improve. Maybe we need to do this." CS1L3 (4 years of teaching experience, 3 years of industry experience)

CS1L2 believes that - feedback explain what lecturers are doing wrong and help to improve PBL practice in the future. CS1L4 also adds that it is important for the institute to see the students' and lecturers' performance as equal to the institute's performance thus far, and set a benchmark. CS1L3 suggests that staff's resistance to accepting the change to PBL and imposed time limitations have contributed to the challenges in implementing the PBL approach. Moreover, all the lecturers are required to teach more than three subjects, which is a further time pressure.

b. PBL Process

This case study institute has fully employed PBL through its programme since 2010. PBL was introduced in the belief of establishing generic skills development and, at the same time, upholding the quality of technical knowledge and skills. In the institute's previous approach to teaching, lecturers are expected to conduct lectures and provide learning materials. It can be said that now the teaching environment has slightly evolved.

As displayed in Figure 4-7, the PBL process starts by scaffolding the students with general information before presenting them with a problem statement according to the topics that should be covered in the syllabus. The students are divided into a group of two or three, and are required to identify and understand what the problem centres on. According to CS1L2, CS1L3 and CS1L6, it is compulsory for the lecturer to design the problem statement based on authentic industry problem. Then the students need to list the 3 K's (what they know, what they do not know and what they need to know), obtain information from useful sources, discuss it among members of the group, finalise the findings and present the result to the class as a whole.

Finally, a question and answer session is conducted before the lecturers give their reflections on the students' findings with respect to the learning objective of the topic. In embracing an active learning approach, the lecturer's role in PBL shifts from being a knowledge provider to being a facilitator, who is required to guide and motivate the students to construct their own learning paradigm.

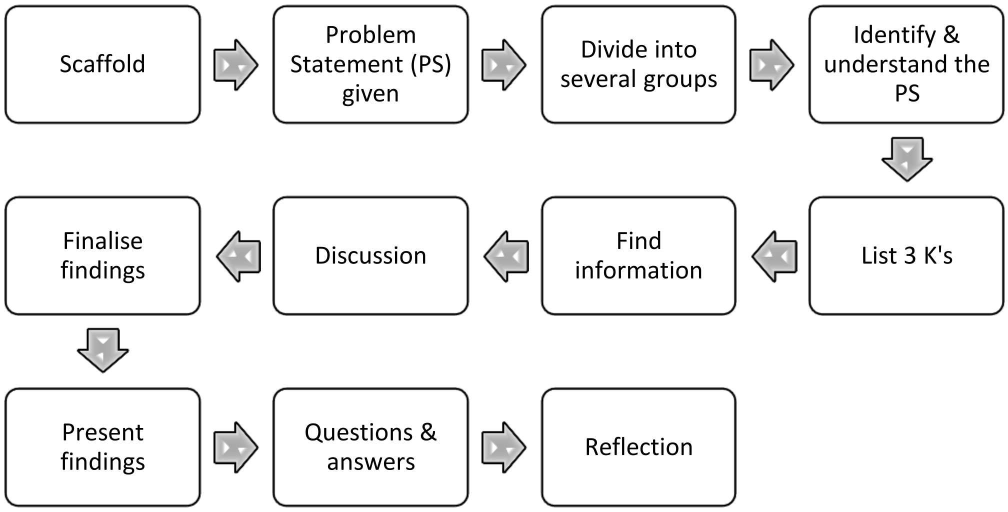

Figure 4-7 Institutional process adapted from lecturers' interviews (Source: author)

Regardless of the challenges of establishing this approach as discussed in the previous section, the lecturers agree that PBL has given benefits to their teaching practice. According to CS1L2, CS1L1 and CS1L6, the PBL environment means less pressure during teaching as attention is now focused on students' learning. Besides providing students with experience in a real working environment, PBL gives an opportunity for students to solve authentic problems faced by industry.

> *"In PBL we have provided a real system for the students to touch, to do, to produce, and to solve the problem, and most importantly to experience it." CS1L6 (10 years of teaching experience, 1 year of industry experience)*

Meanwhile CS1L5 and CS1L7 notice that PBL motivates students to ask questions and indirectly establish a communication with the lecturer. They believe through this process students become independent in their learning and become more knowledgeable, and sometimes even the lecturer obtains new knowledge from students when they are presenting or explaining certain topics. CS1L7 also adds, that students' curiosity and their asking questions encourages him to be more prepared before the PBL session.

> *"Students are eager to ask questions, and this has motivated me to update and increase my knowledge before the PBL session is conducted." CS1L7 (4 years of teaching experience, 13 years of industry experience)*

c. Students' Learning

The findings from the lecturers' transcripts lead to the conclusion that the students' acceptance of the PBL approach was initially minimal. With the limited knowledge that the lecturers have about PBL, they had a hard time convincing their students of the approach and to guide their learning. CS1L1 concludes with the students' and lecturers' frustration:

> *"Some of the arguments came from the students' issues where the students had never heard about PBL before, so they questioned us whether or not this was the best approach for them. Are they the specimen, or are they being subjected as experiments to this approach since they are the first batch? We are not using it just for the seminar, we are not using it just in small lectures, but we are applying it for the whole institute and the whole semester of students. Just imagine, we have undergone PBL introduction for maybe about one or two days only. So the approach is still new to us." CS1L1 (5 years of teaching experience, 2 years of industry experience)*

The transcripts also show the lecturers have evidenced that students do not understand the objectives of implementing PBL and, because of that, they have negative impressions of the lecturers.

> *"Some students thought that the lecturers were lazy to teach and that is why we introduced PBL, for them through PBL we don't have to do much work." CS1L7 (4 years of teaching experience, 13 years of industry experience)*

> *"I have asked a few students what they understand about PBL, and they honestly admitted that they don't have an idea what it is all about." CS1L4 (7 years of teaching experience, 3 years of industry experience)*

From the perspective students' learning, the nature of PBL requires students to interact and communicate with surrounding people and to deliver presentations in front of the class. This has been identified by CS1L3, CS1L6 and CS1L7 as one of the main challenges for students who are inactive, too shy or do not like to socialise with others, especially with an audience. These are the groups of students which have been identified as potential students who are going to be left behind during the learning process. Furthermore, in PBL, the successfulness of the approach depends on the students' initiative to learn.

> *"PBL's success depends on the student, whether he or she wants to learn or not. If I have students who don't even bother to learn, you can't expect good results from him or her because they will take the time given to them to do something else. For example, if we allow them to use the internet for finding the solutions they will use it to access their Facebook and so on." CS1L5 (5 years of teaching experience, 3 years of industry experience)*

Other challenges faced by students identified by the lecturers include that students are easily de-motivated if they are unable to solve the problem; the lack of PBL facilities; the limited time to prepare and present the findings.

Despite all the difficulties, all the lecturers believe that PBL can be a good approach for the development of the students' learning, if it is implemented in the right way. CS1L3 describes PBL as an informal class environment, where he can easily engage with the students and establish a relationship in order to understand their needs better. CS1L4, CS1L5 and CS1L7 further describe PBL as offering students the freedom to choose their way of learning and become more responsible for their learning. The interview findings also show that most of the lecturers believe PBL has improved the students' abilities, such as their presentation skills, report writing, communication skills, good reasoning skills in solving authentic problem, and being able to collect and disseminate information to others.

> *"I suppose through PBL the students become more independent, more knowledgeable, and able to understand the specific topics because, for every topic in the syllabus, there are problem statements to be solved." CS1L4 (7 years of teaching experience, 3 years of industry experience)*

CS1L5 adds that students have learnt more than what it is included in the syllabus, as they need to conduct their own research from multiple resources on particular topics and share said information to and from other students. CS1L3, for example, states he gains benefits from the approach as he sometimes learns something new from his students.

From the teaching perspective, knowledge imparted by the lecturer now depends less on books and handouts and more on industry material and experiences.

> *"… The knowledge and materials that I have given out to the students are from actual industry experience. I use lots of product catalogues, and data sheets as compared to text books, because most of the text books have lots of fundamental equations that we do not even apply." CS1L3 (4 years of teaching experience, 3 years of industry experience)*

The findings also show that the reflections completed at the end of each PBL session motivate students to learn and help them to improve what they have previously done wrong.

> *"I will comment at the end of the session and, of course, give a positive comment to get them going." CS1L2 (4 years of teaching experience, 2 years of industry experience)*

> *"They need to find their own understanding before I can reflect what the core knowledge of that specific topic was at the end of the class. This is to ensure that they can see whether their understanding towards that topic is correct, near to par or below par." CS1L1 (5 years of teaching experience, 2 years of industry experience)*

In conclusion, I can summarise that all these factors, which concern PBL awareness, its processes and students' learning, are related to each other to confirm its practice in this HE institution. Despite the challenges faced by the lecturers, PBL when correctly implemented and practised may lead to successful teaching which, in turn, could lead to a successful learning.

4.2.3 Generic Skills Development

This section presents the findings on how generic skills namely; problem-solving, verbal communication and teamwork are developed in the PBL environment from the lecturer's perspective. In the PBL environment students are educated to work in a group, conduct presentations in front of the class and solve authentic problems. Therefore, it is important for the researcher to understand the activities involved, how the skills are developed and later, provide evidence whether or not such activities are considered during the assessment.

a. Problem-solving Skills Development

As discussed in the previous section, students are expected to solve authentic problem statements in every PBL session throughout their study programme. By using this approach, it is believed that students' problem-solving skills are developed. Most of the lecturers say they have to design problem statements based on their past experience in industry, through discussions with their colleagues and referring to the Internet. However, according to CS1L6, he also considers the availability of components or equipment in the lab before designing the problem statement. Furthermore, he recommends that lecturers should be more proactive in updating problem statements with the current or latest industry problems and how these can be solved by current technology. He believes that this help students.

The findings show that there is no standardisation in designing problem statements; this means that level of difficulty, the topics covered and approaches are different for each individual lecturer.

> *"There are no standardised problem statements in PBL. It depends solely on the lecturer individually." CS1L5 (5 years of teaching experience, 3 years of industry experience)*

CS1L2, CS1L3 and CS1L6 agree that it is not necessary to have the same problem statement in all the classes because every lecturer has their own way of doing things. According to CS1L4, CS1L3 and CS1L5, the students are educated with the 3 Ks method. This method helps the students to break down what they know, what they don't know and what they need to know, in order to solve the problem.

“They will start solving problems with the 3 K’s: what they know, what they don’t know and what they need to know. They have the framework; basically they just go with it.” CS1L3 (4 years of teaching experience, 3 years of industry experience)

The approach motivates the students to ask and answer questions by themselves, especially during question and answer sessions. These enable students to reflect on their experiences and thinking regarding the problem.

“There are many answers to many questions, such as during the Q & A session, some come out with good answers and some might not but it shows what they are thinking. They put in effort, they enjoy being in the classroom and that is a very good experience for them. CS1L7 (4 years of teaching experience, 13 years of industry experience)

Other common activities prepared by the lecturers in order to develop the students’ problem-solving skills include ways of gathering information from multiple resources, presenting and discussing possible solutions to the class, troubleshooting, and designing and installing the Mechatronics system during the subjects’ and final year projects.

b. Verbal Communication Skills Development

Although the institute’s policy requires lecturers to conduct their classes in English, there is evidence that lecturers sometimes have to translate from English to Malay. According to CS1L6, this has to be done to ensure that the students understand the discussed topic because English is not the first language for most of the students. However, learning materials such as handouts, books, manuals and other references used are all written in English.

In Malaysia, there are several ethnicities, the main three being Malay, Chinese and Indian, each has its own mother tongue. Hence, in PBL, students are encouraged to understand and speak in the English language, both formal and informal class settings.

“I think you will have realised that our students consist of students from multi-racial backgrounds. The problem is that they prefer to speak using their mother tongue. I have to stress the need to speak English in my class, and say that using other languages is not acceptable in my class.” CS1L2 (4 years of teaching experience, 2 years of industry experience)

The PBL environment offers a great classroom setting for verbal communication skills to be developed among students, and between students and the lecturer. Students are expected to understand and demonstrate their understanding of the subject content. The activities involved are: explaining, discussing and debating the focus topic. According to

CS1L3, these activities have encouraged students to ask questions and this indirectly establishes a two-way communication.

> *"A lot of the two-way communication involved during PBL provides a very good advantage. It is not just a one-way communication where the students are present and just sit back and listen. It is more like a casual conversation; even during the presentation other colleagues can interrupt and ask questions. So there are lots of conversations happening." CS1L3 (4 years of teaching experience, 3 years of industry experience)*

Presentation is a common practice that takes place at the end of the PBL lesson, so that students demonstrate their understanding of what they have learnt. In order to do this, students are required to do some research, conclude their findings and prepare slides as well as conduct mock presentations among team members. All the lecturers confirm that these practices, builds up the students' confidence and that they are well prepared before the actual presentation.

> *"The students need to present what they have learnt during that time, explain the results of the experiment and conclude their findings. There are presentations in every class. It has somehow improved the students' confidence to speak." CS1L1 (5 years of teaching experience, 2 years of industry experience)*

However, CS1L6 notices that the students have difficulties explaining fluently in English.

> *"They can't explain fluently especially via the English language. The problem of the students is that they fail to explain clearly within the given time. That is the problem. They need more time to think in order to explain the operation. CS1L6 (10 years of teaching experience, 1 year of industry experience)*

According to CS1L4 and CS1L7, during the project implementation, it is routine for the students to have meetings and update the lecturer on their progress of work; for example: problems and challenges faced, how they managed to solve the problem and whether the project is ahead or behind schedule.

c. Teamwork Skills Development

As stated in Chapter 2, the researcher uses the terms "group" and "team" synonymously. Teamwork skills are usually developed when any work that needs to be done in a group is conducted. CS1L1 further describes teamwork as being critically important in ensuring the objective of the work is achieved. In the process, he gives flexibility to the students to choose their own team members because, for him, the students know their colleagues' capabilities and with whom they can easily work. However, CS1L7 has a different point of view. He is quite sensitive about students dividing themselves into groups, because in the end, students who are not good academically and technically are left out behind and end up being in the same group. He prefers that the lecturer divides students into groups, because in industry the graduates will not have the opportunity to choose their own team members.

> *"I had the experience of giving the opportunity for the students to choose their own team members. It ended up with all the below average students being in one group as no one wants to choose them. So, I guess it is not fair for them. Furthermore, later at the workplace, they will not have the chance to pick their team members; everything is decided by their superiors." CS1L7 (4 years of teaching experience, 13 years of industry experience)*

Most of the lecturers suggest that the ideal group size is less than five students to avoid having a "passenger". To be successful in teamwork, CS1L4 and CS1L3 demand the students are aware of their own and other team member's tasks. Tasks need to be divided equally among the team members. Their statements also encourage students to co-operate together and to help others when required.

CS1L6 motivates his students by telling them to promote good communication, share ideas and conduct frequent discussions with each other during group work, especially when any decisions have to be made. He further adds that failure to do this leads to miscommunication which can affect the group performance and relationships, and can delay the outcome. Hence, it is important to ensure that every member understands and agrees on the measures to follow after the discussion process. CS1L2 agrees and adds that teamwork can be more effective if the students are willing to help others, especially those from different backgrounds and who cannot understand, or do not really understand what they have learnt. Other common answers given by lecturers about activities that take place in groups are: presentations, projects and discussions.

4.2.4 Lecturers' GSA Approaches

This section focuses on the lecturers' assessment approaches of the three generic skills – verbal communication, problem-solving and teamwork. The findings show that most of the specific attributes considered during the generic skills assessment are based on the lecturer's experiences in industry. What they experienced in "those days" outside the institute is reflected in the way in which they assess their students' generic skills.

> *"I evaluate them based on the things which I think were important during my time in the industry." CS1L1 (5 years of teaching experience, 2 years of industry experience)*

The lecturers also acknowledge that generic skills assessments are done generally, a specific tool – like a rubric is not given or applied during the assessment.

> *"We don't have a rubric for the assessment. I just observe generally, not in detail, I do not break it into small criteria." CS1L2 (4 years of teaching experience, 2 years of industry experience)*

> *"… We don't have a specific tool to measure how far they have improved progressively in their soft skills." CS1L1 (5 years of teaching experience, 2 years of industry experience)*

Furthermore, the generic skills assessments that were conducted focused on the outcome of the project or presentation, rather than on progressive evaluation.

> *"I mostly evaluate the generic skills through presentations and from there I will know if this person has delivered their task well enough or not." CS1L1 (5 years of teaching experience, 2 years of industry experience)*

> *"That is why I said it is difficult to evaluate every student in a short period of time." and "… if I am required to assess the generic skills, I prefer to assess at the end of the subject, what I mean is the outcome." CS1L6 (10 years of teaching experience, 1 year of industry experience)*

The cause of all the above comments is primarily due to the limited time allowed to conduct an assessment.

> *"… Say the duration of the class is 72 hours; it is not enough for me to know the students' ability and to assess them on their soft skills. It is a very short time to judge the students." CS1L5 (5 years of teaching experience, 3 years of industry experience)*

However, if they were to be given sufficient time to conduct assessments, most of the lecturers would prefer to assess generic skills progressively.

> *"That is why I said 72 hours is not enough. Probably it can be improved if we assess them continuously." CS1L5 (5 years of teaching experience, 3 years of industry experience)*

> *"For me, generic skills evaluation should be started from the very first day until the last day of their studies. Only then can we judge their performance." CS1L1 (5 years of teaching experience, 2 years of industry experience)*

a. Problem-Solving Skills Assessment

Problem-solving skills assessment is reported to be based on the lecturers' observation and evaluation during the presentation and, question and answer session.

> *"Whether they have good problem-solving skills or not, you can see their ability during the presentation." CS1L3 (4 years of teaching experience, 3 years of industry experience)*

CS1L3 and CS1L4, for example assess the way students deliver their solutions and are more concerned with thinking and reasoning skills.

> *"I assess the way they get the solutions, their thinking process and why the procedures are taken." CS1L3 (4 years of teaching experience, 3 years of industry experience)*

> *"I give them marks based on the process they choose and how they solve it and why they do it that way." CS1L4 (7 years of teaching experience, 3 years of industry experience)*

The lecturers are interested in the students' ability to find information from their resources and in how the students use what they have learnt previously when solving the problem.

> *"I assessed how the students were able to gather the information from the internet, friends, books, and so on. I must admit they are good at finding information. But sometimes they don't know how to apply or use the information to solve that problem." CS1L5 (5 years of teaching experience, 3 years of industry experience)*

Although the students are taught to use the 3 Ks approach when solving problems as described in the previous section, the researcher realised none of the lecturers considered it during assessment. Another factor that is not being considered during assessment is the time taken to solve the problem.

b. Verbal Communication Skills Assessment

Verbal communication skills assessment is mostly conducted during the demonstration, presentation and question and answer (Q & A) session. Assessment criteria considered in the assessment are fluency and an appropriate use of the English language, knowledge of the discussed topics and confidence levels.

> *"Of course the marks I give will be based on the contents itself. Then in terms of the verbal communication skills, normally I will focus on how they deliver it, their fluency, and confidence." CS1L3 (4 years of teaching experience, 3 years of industry experience)*

> *"I usually assess their verbal communication skills during their presentation and demonstration. For example, when they do programming, they have to explain to me using the English language including how they write the program and how the program works from the start till the end. If they understand, they should be able to explain that to me." CS1L2 (4 years of teaching experience, 2 years of industry experience)*

How the students manage to answer questions and how they prepare their presentation are also among the criteria that are considered during verbal communication skills assessment.

> *"One more is their preparation, how prepared they are. This means that when they present, they elaborate on the presentation slides or they just read it. Do they manage to answer the questions from the audience or not? If they answer, are the answers reliable?" CS1L7 (4 years of teaching experience, 13 years of industry experience)*

c. Teamwork Skills Assessment

The findings show that the lecturers prefer to assess teamwork skills during the group presentation and Q & A session, but not during group discussions. The interview findings indicate that some lecturers assess teamwork skills individually, some as a group and some considered both. CS1L1, for example, assesses both individually and in groups.

> *"If the person did not manage to solve the problem, then I will ask another team member to solve it. Then I will assess from the team approach." CS1L1 (5 years of teaching experience, 2 years of industry experience)*

Criteria such as the students' ability to work in a group, participate, share knowledge, help others, distribute tasks for each group member fairly, and understand individual responsibility to the group are quite common answers from the lecturers when asked what they look for when assessing teamwork.

> *"I will ask a specific person during Q & A. So I don't want only one person to dominate in answering for the group, from there you can actually see either all the group members really participated during their PBL work or they didn't." CS1L3 (4 years of teaching experience, 3 years of industry experience)*

4.2.5 Lecturers' Challenges in GSA

This section depicts the challenges faced by lecturers in their approaches to assessing their students' generic skills. The findings show that the lecturers' feedback is generally lacking in substance since they have limited knowledge and experience of assessing generic skills. Although PBL training was provided before the lecturers adopted the new approach, none of the training content related to generic skills assessment. This factor adds to the confusion and results in the lecturers having less of an understanding of what they are supposed to assess regarding these skills. As there are no standard assessment schemes, every lecturer has their own interpretation and individual way of assessing the levels of skill.

> *"… There is no schematic assessment, no assessment sheet on what the portions are of those soft skills and no criteria being stated that refers to those skills." CS1L1 (5 years of teaching experience, 2 years of industry experience)*

CS1L2 and CS1L5 for example honestly admit that they are unsure what to assess in generic skills assessment.

> *“Frankly it is hard to assess the generic skills if you yourself are unsure what to focus on.” CS1L2 (4 years of teaching experience, 2 years of industry experience)*

> *“I don’t really understand, especially on the assessment. I mean, how to assess the students, it is difficult for me.” CS1L5 (5 years of teaching experience, 3 years of industry experience)*

Surprisingly, owing to the limited time, some of the lecturers did not even assess the skills at all, although the skills are listed among the intended learning outcomes.

> *“I didn’t do any generic skills assessment because I didn’t ask them to do a presentation, Q & A session or any of it, I didn’t have them. All I did was a writing test, a practical test.” CS1L4 (7 years of teaching experience, 3 years of industry experience)*

> *“I am not including the generic skills in my assessment. If I assess each of the individual students most probably the students, those who are really weak in English, will fail.” CS1L6 (10 years teaching experience, 1 year of industry experience)*

In looking for an in-depth understanding of this matter, some other statements from the lecturers include: “I am not sure how to evaluate the skills” or: “I just assess based on my experience”. The findings also supply evidence that the assessments are not well aligned with the engineering curricula and teaching methods.

> *“… We had so much group work, many discussions and presentations so there should be more assessments that we can do, but we are not doing them” CS1L5 (5 years of teaching experience, 3 years of industry experience)*

Most of the lecturers who conduct a generic skills assessment based it solely on their own observations and judgements. No other elements, for instance, self- and peer-assessment, are integrated into the assessment. A gap is thus created for the lecturer alone to assess these skills.

> *“… We are talking about 50 students for one lecturer to observe. I think it is quite difficult to identify each student’s performance individually.” CS1L3 (4 years of teaching experience, 3 years of industry experience)*

The findings show that curricular developments involved discussion with industry once in a while, but their focus is mainly on technical knowledge and skills. None of the discussion embedded or updated the soft skills attributes that the industry requires. In addition, the lecturers feel themselves that they are failing to keep up to date with current technology and are not incorporating enough authentic industry problems in their classes.

> *“There is a lack from my side, actually I am supposed to look at what is required in the industries, I mean what the current problems are in*

the industry and bring them back to the class as problem statements." CS1L6 (10 years of teaching experience, 1-year industrial experience)

"I have been informed by my friend in the industry that the problems are no longer the same as we used to have." CS1L4 (7 years of teaching experience, 3 years of industry experience)

4.2.6 Summary of the Lecturers' Perceptions of GSA within the PBL Environment

It is important for the researcher to understand in-depth how PBL is implemented in this institute, so investigations include: how it is implemented, or not and its challenges and benefits. Table 4-2 presents a summary of the lecturers' teaching practices within the PBL environment (refer to Chapter 4.2.2).

Table 4-2 Summary of the lecturers' teaching practices within the PBL environment (Source: author)

Description		Lecturers' Teaching Practice
AL Awareness	**Approach**	PBL
	AL Implemented	2010
	Training	Yes (1-day)
	Understanding	Not clear
	Written Guidelines	No
	Institution Supervision	No
Students' Learning	**Learning Motivation**	Solving problems
	Venue	Classroom
	Time	Every subject
	Challenges	Minimal acceptance by the students, lack of facilities, limited time to prepare.
	Advantages	Informal class environment, improved knowledge and skills, refer to multiple sources of information, students' driven, motivated students' learning.

There are lots of learning opportunities provided by the lecturers in developing students' generic skills. Table 4-3 summarises the attributes involved in developing the skills as reported by the lecturers (refer to Chapter 4.2.3).

Table 4-3 Generic skills development by PBL lecturers (Source: author)

Generic Skills	Generic Skills Development
Problem-Solving	Identifying the problem, solving authentic problems, 3 K's method, being resourceful, preparing possible solutions.
Verbal Communication	Presentation and demonstration, explaining fluently in English, discussion, interaction with people directly and via technology, updating the project's progress verbally.
Teamwork	Group presentation and discussion, objective of focus, delegating tasks, being aware of individual and other members' roles, building cooperation, sharing knowledge and ideas, updating individual progress.

Table 4-4 presents the assessment task involved in generic skills development in this case study (refer to Chapter 4.2.4).

Table 4-4 Generic skills assessment tasks (Source: author)

Generic Skills	Assessment Tasks
Problem-Solving	Presentation and Q & A
Verbal Communication	Demonstration, presentation and Q & A
Teamwork	Group presentation, project and Q & A

Table 4-5 summarises the generic skills assessment criteria or attributes, as reported by the lecturers during interviews (refer to Chapter 4.2.4).

Table 4-5 Summary of lecturers' description of generic skills assessment (Source: author)

Generic Skills	Assessment Descriptions
Problem-solving	Reasoning skills, ability to find information, applying previous knowledge and skills, able to solve problems.
Verbal Communication	Fluency and an appropriate use of the English language, understanding content of presentation, confidence levels, able to answer questions, preparedness.
Teamwork	Working in a group, participation, sharing knowledge, helping others, fair task distribution, taking individual responsibility.

Table 4-6 outlines the challenges faced by the PBL lecturers when conducting generic skills assessments (refer to Chapter 4.2.5).

Table 4-6 Lecturers' generic skills assessment challenges (Source: author)

Challenges	Description
Training	Not provided
Limited Time	Yes
Assessment Scheme	Not provided
Assessment Method	Lecturers' observation
Industry Feedback	No

One of the lecturer's transcripts is shown in **Appendix 5A**.

4.3 Findings of Students' Perceptions of GSA within PBL Environment

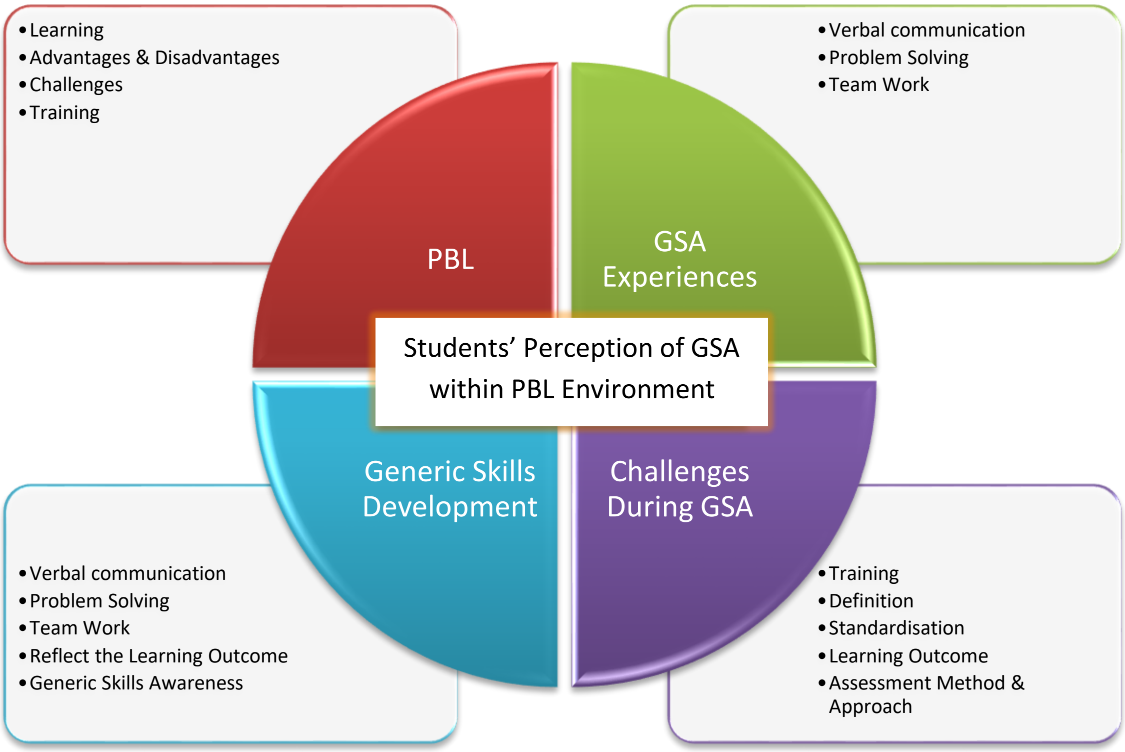

Figure 4-8 Students' perceptions of GSA within PBL environment main themes (Source: author)

Eight final year Mechatronics Engineering students are selected for this case study. These students have nearly completed their studies within the PBL environment and have experience in generic skills assessment. The characteristics of those selected are their age, gender, ethnicity and educational background. These criteria are critically important to allow the researcher to gain a variety of reflections regarding experiences of PBL in HE.

Semi-structured interviews are conducted which aim to understand the students' experiences throughout the assessment process. The interviews begin with open-ended questions, basically to gain knowledge of their background so as to calm them down and settle them, informally, into the process. This is followed by more structured questions, to gather information about their course within PBL, aspirations and relationships with others. In particular, the students' perceptions of the generic skills assessment in the PBL environment are explored; their likes, dislikes, abilities, motivations and participation are also brought into play. As with the lecturers' analysis, the interviews are transcribed, then categorised with a range of synonyms and words associated with keywords. In this section four keywords (themes) emerge from the scripts as shown in Figure 4-8: PBL, generic skills development and assessment, and their challenges. Accordingly, these findings and analysis validate the lecturers' practice in developing the skills and their assessment approaches.

4.3.1 Students' Background

Table 4-7 presents the students' brief biographies. As the information presented is authentic, pseudonyms are utilised to enhance confidentiality. As with the lecturers' analysis, names are created for the participants, and only recognisable to the researcher.

As can be seen from Table 4-7, eight respondents participated in this study. The information on the participants' profiles is presented in Figure 4-9, Figure 4-10, and Figure 4-11, respectively.

Table 4-7 Students' biographical background (Source: author)

Participant	**Biographical Background**
Case Study 1	
CS1S1	A 21-year-old male student. He is a fresh Malaysian Certificate of Education (MCE) leaver.
CS1S2	He is a 23-year-old student. He holds a certificate in Electronic Engineering and is continuing his studies in this institute.
CS1S3	A 26-year-old male student. He has 5 years of experience as a support worker. He is an MCE leaver.
CS1S4	A 21-year-old male, an MCE leaver.
CS1S5	He is 21years old and a fresh MCE leaver.
CS1S6	A 21-year-old female student. She was a fresh MCE leaver when she began her studies in this institute.

CS1S7	He is a 23 years old student. He is a Malaysian Higher School Certificate (MHSC) leaver.
CS1S8	She is 26 years old. She has a diploma in Electrical Engineering.

Note: The year in which data is collected is 2014

This section is important as it provides basic information about the participants in this research, including gender and age. The academic background consisting of each student's previous school is also considered. Data from this section might be useful in providing additional information as to how the distribution of gender, and age, as well as school background, might affect the students' understanding of generic skills assessment and learning process.

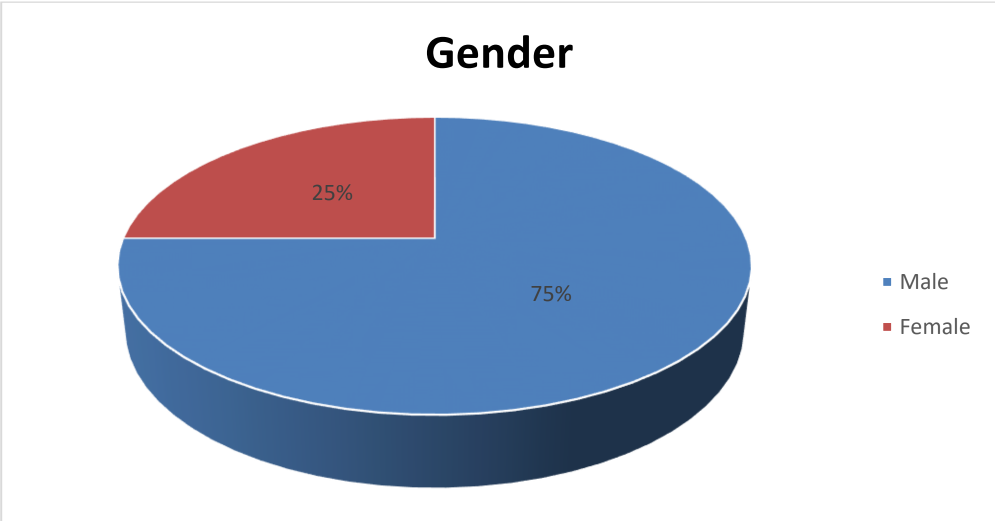

Figure 4-9 Distribution of students' gender (Source: author)

Figure 4-9 shows the demographic profile of the respondents. In terms of gender, six students are male (75%) and two female (25%).

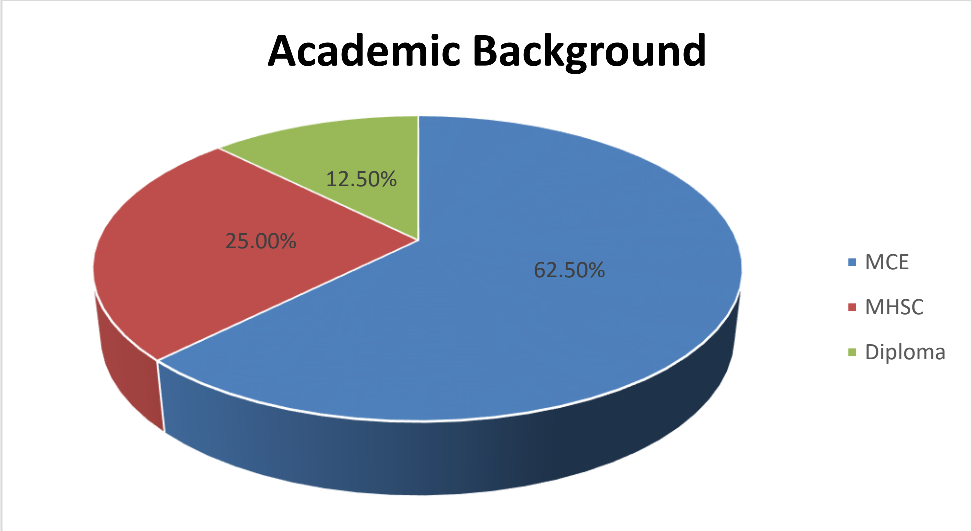

Figure 4-10 Distribution of students' academic background (Source: author)

With reference to the students' academic background, the majority of students (62.5%) are MCE (The Malaysian Certificate of Education, equivalent to GCE O' Level) leavers, with two students (25%) having earned a Malaysian Higher School Certificate (MHSC) and only one student (12.5%) who is a diploma holder, as shown in Figure 4-10.

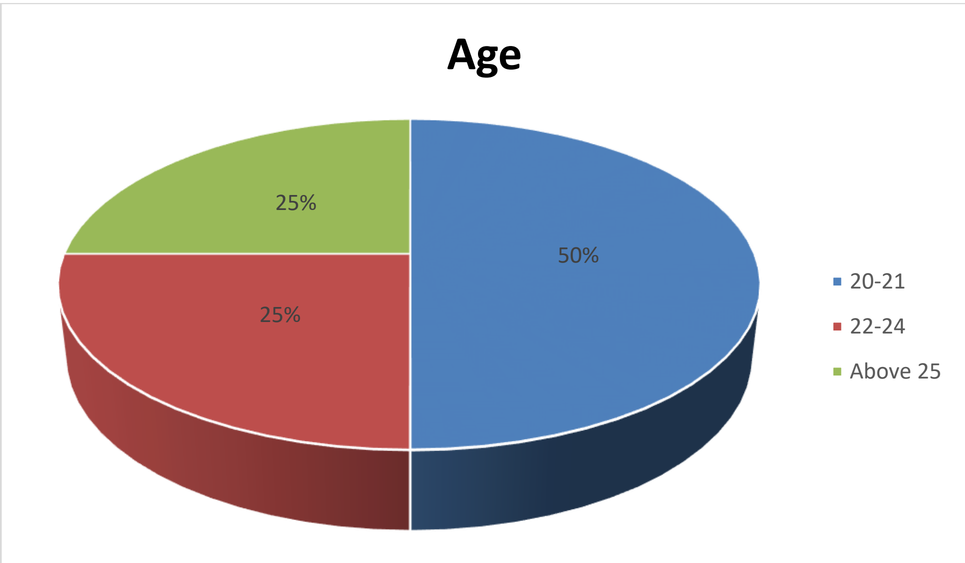

Figure 4-11 Distribution of students' group of age (Source: author)

As displayed in Figure 4-11, most of the participants (50%) are aged between 20-21 years old, two students (25%) are between 22-24 years old, while another two students are above 25 years old.

4.3.2 Students' Learning within PBL

The findings clearly identify that none of the students has experienced PBL or any active learning approach before entering this institute. Most of the students feel that they received a "culture shock" when they were first introduced to PBL early in the induction week. They also report that there were no proper PBL guidelines and training given, either verbally or in writing. However, they claim, after undergoing two or three PBL sessions, they acknowledge had a good view of the PBL process.

CS1S1 and CS1S4 realise that the success of PBL relies on the students' understanding of the problem statement and their initiatives to learn. The lecturers are also reported to play an important role in engaging and motivating the students with their learning.

> *"It depends on the teacher's approach towards PBL. If the lecturer is very enthusiastic for us to learn, it will motivate the students to find the knowledge by themselves. If not, you know what will happen. That is the difference between an effective teacher and a non-effective teacher. For me, I am easily affected in that way." CS1S6 (21, MCE leaver)*

In this case study, the students need to undergo six semesters of studying before they can graduate. For the first three semesters, they learn mostly general subjects, while the remaining three semesters focus on the core subjects. According to CS1S2 and CS1S5, most of the general subjects are conducted completely using a PBL approach while for discipline subjects, they only experience around two-three PBL sessions for each subject. They also add, during PBL sessions, it requires students to actively discuss, find information, solve the problem statement, work in a group, and interact with the people surrounding them, for example, lecturers, colleagues and vendors.

Most of the students believe PBL has helped their learning and developed their generic skills, especially in critical thinking. CS1S2, CS1S3 and CS1S4, for example, prefer PBL as their learning approach, compared to their experiences during secondary school, because of the active participation, and the interesting and fun environment, which makes it easier to understand and learn. CS1S4 and CS1S6 share the same thought and add that they have become more independent throughout the process; meanwhile CS1S8 claims that PBL has helped to develop her reasoning and communication skills. She says that, before PBL, she is not very social; however, PBL has changed her to a talkative person who can easily mix with others. Another benefit of PBL, most of the students reveal, is that the reflection after each of the PBL sessions helps them to realise their mistakes and what should be done differently and better in the future.

Time constraints in PBL such as to understand the problem statement, find information from various sources and prepare presentation slides, are highlighted as the challenges faced by the students in adopting the approach. Students rely on facilities such as the Internet, library books and engineering catalogues to find most of the information related to the given problem statement. Nevertheless, according to CS1S5, the Internet has become the most reliable source of information. This has caused some students to depend too much on the Internet and has indirectly encouraged students to plagiarise information needed from this medium.

> *“My colleagues and I always copy and paste information from the Internet. I think it is normal in PBL.” CS1S3 (26, MCE leaver)*

4.3.3 Generic Skills Development

This section presents the findings of the students’ experiences in cultivating generic skills, namely: problem-solving, verbal communication and teamwork within the PBL environment. As mentioned in the previous section, PBL environment has clearly provided opportunities for students to work in groups, interact with people surrounding them and solve the problem statements. Consequently, it is important for the researcher to recognise the activities involved, how the skills are nurtured and later, verify the lecturer’s practice in developing those skills.

Generally, the students are aware of the importance of acquiring and developing generic skills, either in HE or, later, in the workplace. For example, CS1S2 states:

> *“I am sure I will face more problems that I need to solve later in the workplace, and at that time the skills that I have developed here can be applied to solve those problems. This will give me an advantage to think critically as well.” CS1S2 (23, Certificate holder)*

CS1S3 believes that generic skills are likely to help him in job interviews:

> *“Frankly speaking, I have less experience attending interviews. That is why I think generic skills would help me to pass the interview. When the employer realises how confident I am when answering their questions and that I am able to elaborate my knowledge to solve the problem, I bet they will take me on. I got to know, that in an interview, they usually give the interviewee a problem and ask them to solve it. So, I guess I just need to explain and justify my solutions. This is where I can see the benefits of generic skills and doing PBL.” CS1S3 (26, MCE leaver)*

a. Problem-Solving Skills Development

In every PBL session, either in general or the discipline subjects, the lecturer starts by presenting an authentic problem statement to the students and then asking the students to solve it within a certain duration of time. CS1S2 strongly considers himself a failure if he is not able to solve the problem within the allocated time. He further adds that he is aware of how precious this time will later prove to be in the workplace, because being late in solving a problem may cause the company to not be able to develop the solution, or result in a loss of profits that might affect the company’s reputation.

When discussing the method of solving a problem, most of the students agree that they need to firstly understand the problem statement. According to CS1S3 and CS1S4, any problem can simply be solved by using a simple approach using the 3 K's.

> *"From the problem statement we need to write the three Ks, what we know and do not know regarding the problem, and then what we need to know." CS1S4 (21, MCE leaver)*

Based on the students' interview transcripts, the 3 K's method is described as a structured list of information regarding the problem statement which, then is used to identify what other information is needed to solve the problem. However, not all students agree that the method is as simple as that. CS1S7 suggests that the method is confusing. He has experience of asking the lecturer to clarify his difficulties using the method, especially with what is known and what is needed to be known. From his perspective, they look similar. He further reveals that the lecturer is unable to help him convincingly with this difficulty. He also claims that most of the lecturers have used the same problem statements with previous classes. This practice leads to misuse by opportunist students.

> *"Most of the lecturers just print out and then give similar problem statements from the previous batch. So, most of the students can easily ask and get the answer from the seniors and students who have previously taken the subject." CS1S7 (23, MHSC leaver)*

The findings show that students are taught to be able to find information from multiple resources, either written basis, such as the; Internet, books and manuals, or by asking people surrounding them, for example vendors and senior students, especially during the Final Year Project (FYP).

CS1S6 claims that it is common practice in PBL for students to be required to solve problem statements within a group. Having a further discussion on the problem, sharing knowledge, justifying their findings, deciding the best solution at the end of the discussion and presenting it in front of the class are among the students' answers on activities involved in developing problem-solving skills. Besides that, CS1S2 highlights the question and answer session at the end of the presentation has also helped him and other students to develop this skill. The experience of being able to answer questions and explain further to answer his classmates' and lecturers' curiosity has made him become more confident when speaking. CS1S8 agrees with CS1S2 and adds that problem-solving is not simply solving the problem at that particular time, but also reflecting on the quality of the solution and making sure that the same problem will not occur again. According to CS1S3, he feel more confident when he is able to solve and identify the possible solution to the problem.

CS1S5 and CS1S6 realise that there are many ways in solving a problem and recommend always preparing a contingency plan in case the first does not work as planned.

> *"It is not necessary to have only one way to solve the problem. You must always prepare a second answer to your question or contingency plan in whatever you have decided in the first place." CS1S6 (21, MCE leaver)*

b. Verbal Communication Skills Development

Based on the transcripts, the students clearly admit to having conducted presentations, either individually or in a group since entering this institute in the first semester until they graduated. Presentations are a common activity held in each of the subjects throughout their studies within the PBL environment. Through conducting presentations, CS1S4 says he has learnt how to convince and engage with the audience. CS1S1 agrees and adds that he really appreciates the opportunity to apply various methods of presentations in the PBL session. For him, to convey information and to make the audience understand what he is trying to deliver is a big responsibility. Furthermore, it requires good interpretation skills by those listening to the presentation.

> *"We need to avoid any miscommunications throughout the process, do not let them misinterpret our statements. Otherwise we have to accept that the communication has broken down." CS1S1 (21, MCE leaver)*

CS1S7 has benefitted from the mock presentations with his colleagues, which has made him more confident and more prepared before the actual presentation is conducted. All of the students clarify that they need to conduct the presentations in English. According to CS1S8, lecturers consistently encourage the students to converse in English inside and outside of the class.

> *"My lecturer requires that the students speak and conduct the presentations in English. Compared to my time in MARA University of Technology (MUT), here, I am able to practise my English with more confidence, conversing in English in the class and when I went to meet my supervisor, she always motivates me to speak in English." CS1S8 (26, Diploma holder)*

Despite the lecturer's encouragement to converse in English, according to CS1S2 and CS1S4, sometimes the lecturers have to converse using the Malay language in class just to make sure the students understand about the topics or the terms used.

Other activities involved in developing verbal communication skills reported in the students' transcripts are: active interaction with people surrounding them, whether in the class or at the campus; demonstrating system operations; through discussions, sharing information, elaborating ideas and updating project or work progress. However, CS1S5 realises there is not a straight-forward approach to develop verbal communication skills in PBL. He also adds some of the students are better at communication skills, probably because of the way they have been brought up.

The researcher recognises the students' difficulties in developing verbal communication skills. Amongst the challenges identified from the students' transcripts are that they easily become too nervous to speak in front of people, too self-conscious, they are not social people and they prefer to speak in Malay. Furthermore, CS1S8 experiences difficulty conversing in English outside of the classroom because some of the students thought she was showing off. Although, she also adds another factor is perhaps because of her age and she realises most of the students do not feel comfortable when speaking with her. These reasons have de-motivated her to improve her verbal communication skills.

c. Teamwork Skills Development

In the PBL environment, most of the learning activities take place in a group. According to CS1S3, they are usually divided into four or five students in a group, depending on the task and level of the problem or project difficulty. The students clarify that, most of the time, lecturers allow students to choose their group members, with the condition that they need to alternate group members in future group work. Criteria such as students' capabilities, work experiences, possession of good technical knowledge and skills are common answers given by the students regarding how they select group members.

However, this flexibility in choosing team members creates dissatisfaction for some of the students. For example, CS1S8 and CS1S4 complain that they never have the opportunity to decide their group because the decision- making is always dominated by the top students. CS1S5 realises there are two obvious levels of groups of students when students choose their groups themselves.

> *"When we choose the group members by ourselves it creates a problem in the end; brilliant students will choose among themselves so there will be one or two 'super groups'." CS1S5 (21, MCE leaver)*

The students' interview transcripts clearly inform the researcher that they have experienced many activities to develop their teamwork skills. For example, among the students' answer are: brainstorming, discussion, contributing ideas, group presentations, co-operating with other members and learning with each other, distributing tasks equally, and deciding the best solution to problems.

CS1S8 highlights that respecting each other and maintaining good relationships with other team members are crucial to build a mutual understanding. CS1S2 and CS1S6 agree and describe that working in a team requires high tolerance and consideration among group members. CS1S6 further adds in her statement that each of the team members must be aware of other members' tasks and should always update on their progress. This is important because if anyone of them is falling behind, it is better for other members of the group to help. She is also aware of the circumstances of not being an efficient team:

> *"If the group is not effective, it will be difficult to complete the tasks within the time given." CS1S6 (21, MCE leaver)*

However, CS1S5 is not keen with offer too much help to his group members because he believes that some of them take advantage of this. He has experience of covering his colleagues' tasks after being given numerous excuses. CS1S7 has also faced the same experience:

> *"If in a group of five people, only one or two people really want to do the task, the others just like to be passengers: sit tight, wait for the result and then present." CS1S7 (23, MHSC leaver)*

Nonetheless, CS1S8 encounters a different experience during her Final Year Project (FYP) and describes her frustration:

> *"I am the only girl in the group; I prefer to do my work early in the morning… But, the boys, they are the kind of people who like to sleep late; they usually start the FYP work late at around 4 pm and it will drag on until 4-5 am." CS1S8 (26, Diploma holder)*

4.3.4 Students' Experiences during GSA

This section focuses on students' experiences of the assessment approaches in the three generic skills: verbal communication, problem-solving and teamwork. These findings reveal what activities contribute to the marks given by lecturers.

a. Problem-Solving Skills Assessment

Based on the students' transcripts, the researcher is informed that the problem-solving skills assessments are completed based on the lecturers' observations during presentation and question and answer (Q & A) sessions. CS1S1 claims that the lecturers assess problem-solving skills progressively during the sessions. According to CS1S2, CS1S3 and CS1S4, if students are able to answer the questions in Q & A sessions confidently, it contributes to high marks from the lecturer. CS1S3 and CS1S7 further emphasise that the capability to demonstrate good reasoning skills during the assessment would also is an added advantage. However, CS1S5 believes that lecturers assess problem-solving skills based on how students counter any setbacks arising from trying to solve the problem in hand.

> *"Things don't always go according to plan, therefore we need to firstly identify and then think of how we can counter setbacks. For example,*

in the design you think it can fit, but in reality it cannot fit in. So how do you solve that problem? Maybe we should improvise things, for example, grind, fabricate the part, and change the design or whatever." CS1S5 (21, MCE leaver)

Common answers from students regarding what they consider important in problem-solving assessments are: being able to provide a number of solutions; being able to show the process of getting the solution; having good confidence levels; showing knowledge on the discussion topics, and whether or not the problem has been solved.

b. Verbal Communication Skills Assessment

Similarly, most of the students believe that verbal communication skills assessment takes place during presentations, discussions and Q & A sessions. With respect to assessment during presentations, CS1S3 specifically describes the assessment criteria.

"I think the criteria includes eye-to-eye contact, facial expression, body language, tone of voice, enthusiasm, and so on." CS1S3 (26, MCE leaver)

The interview transcripts also inform the researcher that the assessments are based on the lecturers' observations as to whether or not the students have demonstrated attributes such as: fluency; being able to converse in English; good presentation approaches and contents of slides; being able to further elaborate on each point in the slides, and being able to engage with the audience.

However, when considering assessment criteria during discussions and Q & A sessions, many students think that, if they are able to answer questions and are able to make others understand with their explanations, this contributes to the marks given. Furthermore, CS1S5's experience reveals that the assessment of verbal communication skills is not only based on the ability to establish communication and discussion with other students but also with people in general:

"The lecturer is not only concerned with our ability to communicate and discuss with colleagues but with other people as well such as lecturers, vendors, technicians and others." CS1S5 (21, MCE leaver)

c. Teamwork Skills Assessment

The findings show that the students experience teamwork skills assessment through group presentations, projects and demonstrations. According to CS1S7 and CS1S2, the lecturers assess these skills through observations during lab visits and when the students provide updates on their work progress. CS1S7 further claims that group leader feedback on team members and attendance reports are among the criteria included in the assessment.

> *"Every week we need to update on our work progress, the comments from the group leader and then what have they been doing, what the leader has reported about each group member and then their attendance as well, I think the assessments are based on that." CS1S7 (23, MHSC leaver)*

All of the students claim that the assessments are completed in a group. CS1S4 describes briefly how teamwork assessments are made:

> *"The lecturer assesses us individually, but the mark is given in the team. They will calculate the average and everyone will get the same mark. The assessments are usually done at the end of the presentation and project demonstration." CS1S4 (21, MCE leaver)*

Criteria such as the students' ability to work in a group, participate, share knowledge, help others, distribute tasks among each group member fairly, and feel individual responsibility to the group are common answers from the participants regarding teamwork skills assessments.

4.3.5 Students' Difficulties during GSA

This section presents the challenges faced by the students in the generic skills assessment process. Most of the students report that they are aware of when the assessments are taking place; however, they are not confident about what the criteria are for generics skills assessment. This clearly indicates that they are making assumptions about what those assessment criteria might be, when answering questions about them, as discussed in the previous sections. For instance, CS1S6 reveals her thoughts on the criteria of the assessments:

> *"Frankly speaking I am not sure how the lecturer assessed my generic skills. I do not think anyone of us is certain about the criteria." CS1S6 (21, MCE leaver)*

The interview transcripts also confirm that the students are made aware of the learning outcome of the FYP and other subjects, either verbally or in writing.

> *"Normally the lecturer will highlight the learning outcome earlier in the first class in each of the subjects and it is also included in the notes on the first two pages." CS1S7 (23, MHSC leaver)*

However, CS1S4 claims that lecturers only highlight the learning outcomes for technical and not generic skills. When the researcher further asks about the generic skills learning outcome, this is proved when none of the students are able to answer the question.

From the students' interview transcripts, it is clearly shown that the lecturers' assessments of generic skills are not standardised in the sense of the percentage of marks and assessment approaches. For that reason, most of the students think the assessments are unfair for them and this has de-motivated their learning. CS1S1, in his statement, intensely disputes the lecturers' assessment inconsistencies when assessing generic skills:

> *"Even though we answer more or less the same, the marks we get are very different." CS1S1 (21, MCE leaver)*

Another challenge in generic skills assessments reported by the students are that the assessments only depend on the lecturers' limited observations and judgement. CS1S8, for example, claims that the lecturer is not supervising his/her students properly, as most of the time he/she is not in the classroom when the activities are being conducted. CS1S6 also shows her frustration with some of the lecturers' misjudgements towards students who are weak in verbal communication skills:

> *"There are students who can speak but they did not perform their task, and there are also students who are not able to speak properly but they are the ones who did all the work. So from the lecturer's perspective, the one who can speak better is the one who really does the work." CS1S6 (21, MCE leaver)*

With regards specifically to teamwork assessment, CS1S8 and CS1S7 express their dissatisfaction with the lecturers' judgement and assessment.

> *"Since there is no individual mark even though the person didn't contribute to the team and didn't do any work, they are still getting the same marks as the rest of the team members." CS1S8 (26, Diploma holder)*

> *"That is why I think it is unfair for somebody who really works hard on it. The lecturer said that the teamwork marks are given equally in a group." CS1S7 (23, MHSC leaver)*

CS1S3 further claims with that approach towards teamwork assessment, lecturers show their lack of awareness of individuals' performances.

> *"What I can see during the PBL session, mostly we are learning in groups. What happens sometimes is that the lecturer does not realise the individual performance because of too many students to be observed at one time, which is why I recommend there should be an assessment for individuals as well." CS1S3 (26, MCE leaver)*

According to CS1S1, CS1S2, CS1S3 and CS1S4, it is normal to have conflict when working in a group, but students prefer to solve these conflicts by themselves, without involving the lecturer or the supervisor. In addition, according to CS1S3 and CS1S4's experience, if the lecturer sees or is aware of a conflict, this has an effect on the group work marks.

Almost all of the students complain about lecturers' bias when assessing generic skills. For instance, CS1S1 explains that the lecturers are easily biased in assessment, especially those lecturers who have been teaching the same class for a long period of time. In his case, he has been taught by the same lecturer in three consecutive semesters. CS1S3 further adds that there is nothing students can do about bias. If any student reports the issue to management, the lecturer is likely to mark that student poorly and become even more biased.

4.3.6 Summary of the Students' Perceptions of GSA within the PBL Environment

Table 4-8 presents a summary of students' experiences within the PBL environment (refer to Chapter 4.3.2).

Table 4-8 Students' learning within PBL (Source: author)

Description	Students' Learning
AL Experience Previously	None
AL Training	Provided – 1 day (Induction week)
Written Guidelines	No
Venue	Classroom
Time	Every subject
Challenges	Time constraints, lack of lecturer guidance, learning approaches not standardised, plagiarism and in-active students (passengers).
Advantages	Motivate students' learning, offer opportunities to develop generic skills, active participation, interesting and fun environment, easy to understand the knowledge.
Facilities	Internet, library books, engineering manuals and catalogues

Students' interviews reveal that they have experienced and practised attributes of generic skills within the PBL environment during HE. Table 4-9 summarises the generic skills development of the students (refer to Chapter 4.3.3).

Table 4-9 PBL students' generic skills development (Source: author)

Generic Skills	Generic Skills Development
Aware of Importance	Aware
When it is developed	PBL session
Problem-Solving	Solving the problem within time, understanding the problem, applying 3 K's, finding information, discussing, justifying the findings, preparing contingency solutions, deciding best solution, presenting outcome to the class and answering questions.
Verbal Communication	Conducting presentation, convincing and engaging with audience, applying various methods of presentation, conveying information, making people understand the explanation, fluently conversing in English, interacting with surrounding people, demonstrating projects, discussing, updating on work progress.

Teamwork	Selecting team members, delegating tasks, brainstorming, discussing, sharing ideas, co-operating, respecting and maintaining relationships, and tolerating other team members.

Through the qualitative semi-structured interviews, Table 4-10 reviews the students' tasks completed during generic skills assessment (refer to Chapter 4.3.4).

Table 4-10 PBL students' assessment tasks (Source: author)

Generic Skills	Assessment Task
Problem-Solving	Presentation, Q & A and progress report
Verbal Communication	Presentation, discussion and Q & A
Teamwork	Group presentation and project demonstration

The description of the generic skills criteria for assessment reported by the students can be summarised as shown in Table 4-11 (refer to Chapter 4.3.4).

Table 4-11 PBL students' description of generic skills assessment (Source: author)

Generic Skills	Assessment Descriptions
Problem-solving	Process of finding solutions, number of solutions, whether or not the problem is solved in the end, reasoning skills, level of confidence.
Verbal Communication	**During presentation –** eye-to-eye contact, facial expression, body language, tone of voice, enthusiasm, able to converse in English, presentation approach, contents of the slides, further elaboration of each point in the slide and audience engagement. **Discussion and Q & A –** able to answer questions, able to make others understand what they deliver, knowledge contribution and interactions with others.
Teamwork	Progress updates, group leader feedback, students' ability to work in a group, participation, knowledge sharing, willing to help others, tasks fairly distributed and individual responsibility.

The following table, Table 4-12, summarises the generic skills assessment difficulties experienced by the PBL students (refer to Chapter 4.3.5).

Table 4-12 PBL students' generic skills assessment difficulties (Source: author)

Difficulties	CS1
Assessment Criteria	Not aware of the criteria and, when and how the assessment is conducted, described the criteria as too general

Assessment Standardisation	Not standardised
Reflection after Assessment	No
Supervision during Learning	Lack of lecturer supervision
Others	Unfair assessment, lecturer lacked of awareness on individual performance, biased

An example of one of the student transcripts is shown in **Appendix 5B**.

4.4 Findings of Employers' Expectations of Graduates' Generic Skills Attributes

This section presents findings and analysis from five employers, selected by the Mechatronics Head of Section. All employers have experienced working with a number of graduates from this institution and have years of experience in a managerial position. The interviews are held in the employers' premises. The employers are interviewed to determine their expectations of HE in teaching students the necessary attributes of generic skills to the correct level of competency. The employers are also asked to reflect on the current and previous graduates' generic skills performance.

Two keywords (themes) emerge from the scripts: employers' experiences and generic skills attributes. Accordingly, these findings validate the expectations of the stakeholders in industry and how these align with HE practice in developing those required generic skills in students. The results may also contribute to better understanding how to enable students to develop their generic skills and how to assess these skills in HE.

4.4.1 Employers' Background

Table 4-13 summarises the employers' brief biographies. The table shows that all the participants are male. Further information on the participants' profiles is presented in Figure 4-12 and Figure 4-13.

Table 4-13 Employers' biographical background (Source: author)

Participant	Biographical Background
Case Study 1	
CS1E1	He is a 33-year-old male. He has been a Technical Manager at this company for 4 years. The main business of this company is underwater service provider for offshore services. The main clients are Shell, PETRONAS and EXXON-MOBILS. Currently he is responsible for managing more than 80 engineering personnel within 3 departments.
CS1E2	A 46-year-old male director. He started his own business in 2005. Designing and building industrial automation systems is the core business of his company. Most of the clients come from automotive

	industries and education sectors. He manages more than 30 engineering personnel.
CS1E3	A 35-year-old Automation and Project Manager. He has been managing more than 20 engineering personnel in upgrading and improving machine operations for the last 5 years. The main business in this company is food packaging. Most of the clients are from local companies.
CS1E4	He is a 35-year-old male. He has been Head of Engineering and Services for the last 4 years. The core business in this company is to assemble and install biomass (palm oil waste) power plants. The clients come from various locations including Indonesia, Thailand, Myanmar, Philippines and Papa New Guinea. He has experience in managing about 20 engineering personnel.
CS1E5	A 37-year-old male. He has been working in his company for 12 years and has been appointed as a Technical Manager for the last 10 years. The company is an automation and process specialist dealing with process controls. The Main clients are locals and some are from various locations in Indonesia. He is responsible for managing 16 engineering personnel.

Note: The year in which the data is collected is 2014

Data from the following figures might be useful in providing additional information as how the distribution number of PBL graduates working in the company and the employers' number of years in a managerial position, might reflect with their perceptions of engineering graduates' generic skills.

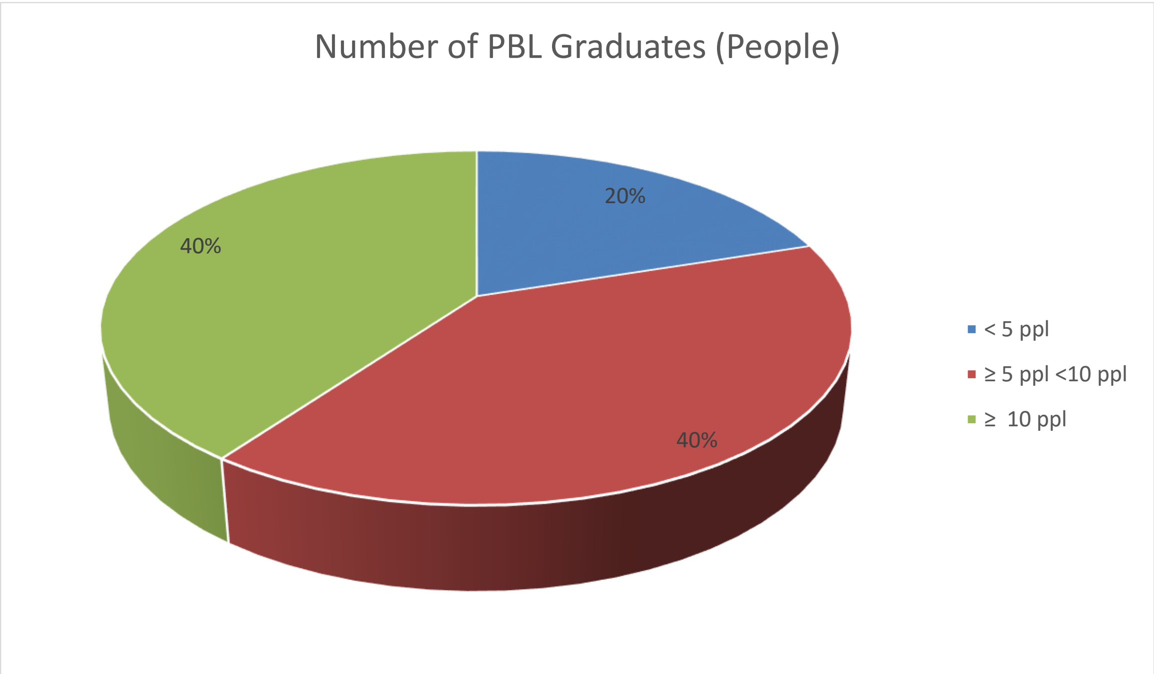

Figure 4-12 Number of PBL graduates the employers have experienced working with (Source: author)

From the demographic forms and interview scripts, only one employer (20%) has experienced working with less than five PBL graduates as shown in Figure 4-12.

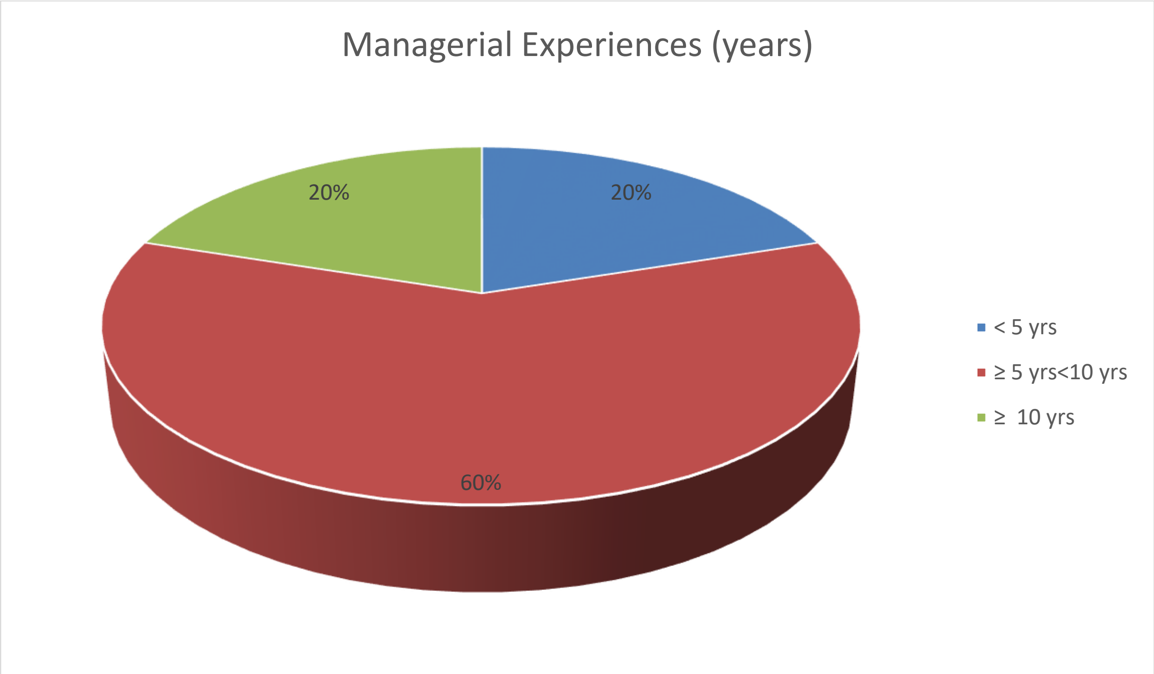

Figure 4-13 Number of years that employers have held managerial positions (Source: author)

As displayed in Figure 4-13, most of the employers have more than five years of experience in a managerial position (80%).

4.4.2 Employers' Perceptions of PBL Graduates' Generic Skills

Almost all of the employers admit that they are not willing to give further training to develop their engineering personnel's generic skills. They further clarify that normally new engineering personnel are informally trained by senior staff when they perform jobs on site.

> *"Normally the junior engineer will be on site for exposure purposes. That is the only time they get to learn." CS1E5 (37, Technical Manager)*

> *"… Obtaining experience through the experience of the seniors." CS1E1 (33, Technical Manager)*

Employers' transcripts clearly prove that the majority of the employers expect HE to completely train and equip their students with the necessary attributes or skills to avoid their company incurring expenditure in cost and time.

> *"I am not sure whether our Higher Education has produced competent workers towards the 2020 vision. Supposedly, by now Higher Education should be able to prepare a worker with the skills to be ready for industry, who does not require other training or whatever. We do*

not have time and in fact we do not allocate for generic skills training." CS1E2 (46, Director)

In contrast, there is a different practice in CS1E1's company, where there is formal training, both for generic and technical skills, which normally takes place throughout the Monsoon season.

> *"We have planned the generic skills and technical training but we are still looking at the Monsoon time. The window that we are looking at is during November and December because during that period of time there is ample time for us to groom such skills." CS1E1 (33, Technical Manager)*

Most of the employers believe and complain that HE has recently neglected qualities, standards and demands from industry. This is indicated in the following comments:

> *"I realised that the graduates' standards are decreasing over the years after the year 2010. What happened is that they never thought that they needed to have those extra skills built in them. They were taught for single tasking. Nowadays we require more than that." CS1E5 (37, Technical Manager)*

> *"HE needs to understand the demands from the industry as we are the end user of their product." CS1E2 (46, Director)*

In commenting on this issue, CS1E5 gives his positive thoughts on this matter and adds perhaps the learning culture has evolved, hence affecting these qualities.

> *"Maybe because of the changes or the evolutions of the culture when bringing up the child, they are different with the way we are brought up, with the way we learnt in school previously." CS1E5 (37, Technical Manager)*

Additionally, according to CS1E3 and CS1E2, the concerns of making mistakes in a real working environment and being too nervous to interact with new people might be other factors that cause graduates not to perform well in their soft skills, in problem-solving and communication skills specifically. CS1E4 shares his frustration of the new graduates' difficulties to converse using English and their lack of initiative to practise communicating with the clients and staff. He suggests that generic skills should be developed by students applying them in actual environments, rather than learning through text books.

> *"You can teach easily whatever knowledge is in books, but when it comes to developing generic skills, students need to practise them frequently on site or in an actual environment." CS1E4 (35, Head of Engineering and Services)*

On the other hand, CS1E1 has faced graduates' having difficulty in explaining what they wanted to do to complete a job.

"Before we execute a job we will have a tool box meeting prior to any job. So when I posed a question on how you are going to do that, and demanded some plans, or a brief description on the task that is needed to be performed, they are not able to explain any of it; but the good thing is they got the job done." CS1E1 (33, Technical Manager)

With regards to the graduates' achievements specifically, most of the employers realise that, even though the graduates achieve good grades in HE, in reality these grades do not reflect their generic skills performance or even their technical skills.

"We didn't require them to undergo the job interview process because of the limited time that we had. We are totally depending on their Cumulative Grade Point Average (CGPA) and the details in their resume, what are their strengths and weaknesses and so on. ...To be frank I am frustrated and confused with their performance. Their achievement does not reflect their generic skills or the technical skills." CS1E3 (35, Automation and Project Manager)

The employers prefer their employees or graduates to possess a balance of technical and generic skills. They further acknowledge that generic skills are normally used to distinguish graduates with the same educational background, as to which are to be selected for jobs and, later, promoted.

"Technical skills and generic skills are equally important for me but to highlight or to make sure they get promoted, generic skills are the criteria that I will look at." CS1E2 (46, Director)

"For me I would prefer my engineer to possess a balance in technical and generic skills, 50-50, so that they can survive longer in this industry. CS1E4 (35, Head of Engineering and Services)

In monitoring their engineering personnel's generic skills performance, the majority of the employers say that they use their companies' standard mechanism, which is the Key Performance Indicator (KPI). In addition, the companies also use comment forms from clients and other staff. However, the employers highlight their difficulties evaluating graduates' generic skills when selecting future employees. They admit that during the job interview the interviewer can identify graduates' communication skills but not teamwork and problem-solving skills.

"During the interview we just look at their communication skills and technical knowledge. Other soft skills like the teamwork and problem-solving, and technical skills, are based on trust from what has been written in their resume and sometimes recommendations from the lecturer." CS1E2 (46, Director)

"Previously, during the job interview, I look at their generic skills' ability, the way they are thinking, the way they are communicating, their attitude, confidence level and only then will we assess their technical

knowledge. I can't assess their teamwork." CS1E3 (35, Automation and Project Manager)

Another issue faced by employers during job interviews is that new graduates demand high salaries. CS1E2, for example, labels current graduates as "money matters" and shares his concern that employers pay amounts that are not commensurate with the skills offered by new graduates.

"Of course the candidates want to know what companies can offer them and I, as an employer, also want to know what they can offer to us." CS1E2 (46, Director)

Despite all the weaknesses reported by the employers, according to CS1E1, PBL graduates have a "bird's eye" view when performing any task. The ability to think ahead and be well prepared differentiates them from other graduates. CS1E1 also praises PBL graduates who have shown a high teamwork spirit.

"That is why we hire PBL graduates, because they are able to cope with the engineers, technicians and the supporting groups. ... PBL graduates exceed my expectations on teamwork." CS1E1 (33, Technical Manager)

CS1E4 and CS1E5 in their comments also recognise PBL graduates as having acquired good thinking skills and being able to solve problems with minimal supervision.

"They manage to troubleshoot and solve problems with less supervision from us." CS1E4 (35, Head of Engineering and Services)

"Basically I spend less time explaining to them the physical elements of what to use, what to deploy and all these things. They are able to work independently." CS1E5 (37, Technical Manager)

4.4.3 Employers' Understanding of Generic Skills and Expected Attributes

This section presents the employers' understanding of generic skills and discusses the expectations of those skills, particularly of the attributes required within the engineering discipline. This information is important to the researcher in order to confirm later the employers' demand that HE institutes ensure their students achieve learning outcomes and acquire the competencies of required generic skills.

a. Problem-Solving Skills

CS1E2 describes engineering personnel who have good problem-solving skills as valuable to all employers.

"The higher the ability you have to solve problems, the more valuable you are to the employers." CS1E2 (46, Director)

CS1E1's, CS1E4's, CS1E3's and CS1E5's transcripts show that they strongly agree with CS1E2, owing to their business's way of thinking that always revolves around solving problems and meeting industry needs. They further clarify that personnel's ability to solve problems benefits employers in minimising operational costs and in avoiding penalty charges that accrue in instances when problems are not solved on time.

> *"We need to minimise the downtime; if not we will be penalised." CS1E4 (35, Head of Engineering and Services)*

Besides time limitations, CS1E5 adds any solution to a problem needs to take into account the costs, and try to optimise fund within the project budget. Furthermore, when describing efficient ways of solving problems, CS1E5 and CS1E1 share the opinion and describe that each personnel should focus on the objective of solving the problem and see things from a macro perspective.

> *"First they must identify the objectives to solve the problem because at the end of the day, it is about the delivery and then making sure they don't sway from the objectives. That is the key to be able to see things from a lot of matrices and simplify the whole process of delivery." CS1E5 (37, Technical Manager)*

However, according to CS1E2 and CS1E4, the most important attribute of problem-solving skills is the personnel should be able to understand and identify the cause of the problem. In further analysis with regards to the approach of solving a problem, all employers give similar comments: that it is critically important to prepare a contingency plan after each decision. CS1E2, for example, encourages his engineers to always think a step ahead.

> *"You need to think one step ahead; what am I going to do if this plan is not working, you need to have contingency for whatever you are solving." CS1E2 (46, Director)*

CS1E5 also shares his practices on how his personnel prepare possible solutions with him, which he calls "creative" approach.

> *"Creative means seeing things and saying things and contributing things from the way you and I see things, but whether it works or not is another kettle of fish, I would say. It is good if it opened up a different perspective." CS1E5 (37, Technical Manager)*

The interview transcripts clearly show that all employers prefer their personnel to solve the problem independently with minimal supervision by their superior, either in the company premises or on site.

> *"Good personnel are personnel who manage to troubleshoot and solve problems with less supervision from us." CS1E3 (35, Head of Engineering and Services)*

However, although working independently is the preference, according to CS1E1, CS1E2 and CS1E4, before any action can be taken in solving a problem, personnel are required to get approval from his or her superior to avoid mistakes happening. They are afraid of what might happen, especially from mistakes: that equipment might be damaged; someone might be injured; profits are minimised or, even worse, there is a resulting loss for the company.

> *"The most important thing before the decision is made is that they must confirm the details of their discussions and get the approval from the management that is in charge for the project." CS1E4 (35, Head of Engineering and Services)*

Other common answers from the employers regarding the attributes of problem-solving skills attributes are that engineers must be able to: find information from multiple resources, justify possible solutions with support from facts and figures, and possess good reasoning skills. CS1E1 states that engineers who have these abilities are resourceful personnel; however, CS1E4 insists the information should come from a trusted source.

> *"Resourceful means someone who is always prepared with the most information and skills that someone could acquire and know where to get other information if it requires knowledge beyond their interests or discipline of study." CS1E1 (33, Technical Manager)*

> *"All information must be based on facts and are reliable from the Internet or books." CS1E4 (35, Head of Engineering and Services)*

The employers also share their ways of assessing their engineers' problem-solving skills during yearly appraisal. CS1E3, for example, includes client satisfaction in his company assessment mechanism, while CS1E5 is more concerned with his personnel completing jobs on time.

> *"We monitor by the successful rate of the assignment or project, more than on the troubleshooting ability actually. And we also observe how many times they call the superior or client, on what they are complaining about. Sometimes we ask the client how our boys are doing their work at the site to see what they have to say." CS1E3 (35, Automation and Project Manager)*

> *"Our KPI (Key Performance Index) is very simple. if we are given the dateline, our personnel have to deliver it on time every time." CS1E5 (37, Technical Manager)*

b. Verbal Communication Skills

When the researcher asks about the expectations of verbal communication skills, obviously the transcripts show that the employers demand graduates who are not only able to conduct a presentation but are able to interact confidently with the customer/client. CS1E2 and CS1E3 share their bad experience with new engineers where the customers/clients complained about their lack of confidence when communicating with them.

> *"They are lacking confidence when communicating with the customer; for example, I still remember when the customer from ******* asked them questions, the graduates just kept quiet and smiled. We expected them to deal with the customer face-to-face, but it ended up me answering all the questions." CS1E2 (46, Director)*

> *"We gave them opportunities to communicate with the contractor; they are not confident if they are alone so we need to be there." CS1E3 (35, Automation and Project Manager)*

CS1E4 describes his engineers as the company representatives or delegates when working on site. He further acknowledges that the ability to communicate with the customers highlights the company's credibility and reputation in industry. CS1E5 recommends that individuals put themselves in the "shoes" of others to establish more effective verbal communication.

CS1E5 and CS1E3 entailed his personnel to get to know their client and required them to be able to verbally communicate with multi-disciplinary, multi-level of positions and multi-racial personnel.

> *"For example, in building an automation project, we are doing projects in government infrastructures so as a particular engineer or technician, he/she has to deal with people from the consultancy side, from the civil engineering side, as well as from the mechanical, electrical and structural side, because all of these will contribute to how we control this infrastructure no matter if it is buildings or facilities." CS1E5 (37, Technical Manager)*

> *"Sometimes they also need to explain to the operator, supervisor or even to the director, where some of them understand technical terms and some do not; so they need to make sure that each level of worker can understand what they are trying to deliver." CS1E3 (35, Automation and Project Manager)*

From the transcripts, it shows that most of the companies have established businesses not only with locals but also with international companies. According to CS1E1, CS1E4 and CS1E5, this means that personnel must be able to converse in English and, sometimes, to be able to converse using the local language.

> *"Our personnel usually interact with people from the Philippines, from British nations, we even had a Nigerian supervisor so the people on board can be from anywhere in the world." CS1E1 (33, Technical Manager)*

"We have projects in most of the places like Thailand, Myanmar, Philippines and Papa New Guinea. Papa New Guinea is manageable because they can speak English, although they are not fluent when speaking. Countries like Myanmar, Thailand and the Philippines are quite different because of their language and accents. But still we require our technicians and engineers to be able to converse in simple English with them." CS1E4 (35, Head of Engineering and Services)

CS1E5 further adds he requires a certain level of English competency before he can hire an engineer or a technician in his company. Most of the employers also admit that personnel who are able to speak multilingual have an incredible advantage. For example, CS1E2's engineers find it difficult communicating with Japanese personnel in one of the companies that specialise in the automotive industry.

"Most of the personnel in one of my customer's companies are Japanese; both my engineers and personnel are not very good in English, so you can imagine how they tried to explain to each other. It was exhausting really." CS1E2 (46, Director)

Debating, arguing and contributing ideas are among the common activities during the discussion process reported by the employers in this case study. CS1E4 encourages his personnel to openly debate any argument because it motivates idea contribution from others during the process. He also highlights that engineers should know his/her equipment well and should acquire good knowledge about the discussion topics.

"They must know their stuff very well, I mean the knowledge on the topics they want to discuss; for example, what kind of devices they have, details specification, how to handle and maintain the equipment and so on." CS1E4 (35, Head of Engineering and Services)

Similarly, they should be able to voice their opinion if any action taken is unsafe or wrong, be able to stand up for themselves and be able defend the company's name are other attributes that the employers wanted.

"I would say it depends also on the individual whether he/she has the confidence as well as the courage to speak up." CS1E2 (46, Director)

"If they feel that the action is unsafe, they have to voice it and explain to people that what they are doing is wrong." CS1E1 (33, Technical Manager)

"Our engineers or technicians should be able to defend themselves from the client's accusations, so that they do not get the blame for the things they didn't do." CS1E4 (35, Head of Engineering and Services)

Furthermore, be it in maintenance or in repairing, it is also stated by the employers that they require engineers who are able to convince and negotiate with the customers. The engineers should possess all the common information that the customers require, such as what components need to be replaced, how long the job will take, how much each part of equipment costs, and if there are any discounts. Furthermore, it is the nature of this business for clients to ask questions. CS1E3, for example, expects his engineers to be able to explain briefly what they have in mind until the customers understand and are satisfied with the given answer. CS1E2 shares his frustration of his engineers who lack this attribute.

> *"I can say they have good technical knowledge and skills but the confidence level to answer any of the questions are lacking." CS1E2 (46, Director)*

According to CS1E3 and CS1E4, it is necessary for their engineers to understand the customers' requirements because misinterpreting the customers' needs might lead to the company facing a loss and, worse, affect future relationships for both parties. In addition, CS1E3 further notices that miscommunication frequently happens between colleagues as well.

> *"The communication with their superiors so far is not a problem; it is just that sometimes their communication with their team members is not good. They usually have a miscommunication among them." CS1E3 (35, Automation and Project Manager)*

The ability to acknowledge or update progress work to their superiors and customers are also highlighted attributes by most of the employers. CS1E1 has experience whereby his personnel were unable to report their achievements verbally during their yearly appraisal; while CS1E2 has received a complaint from his customer because of the failure of his engineer to update the work's progress.

> *"… They can perform their job but sadly are unable to effectively address the plan and communicate with their senior supervisors on what they are doing and what they have done." CS1E1 (33, Technical Manager)*

> *"There was one time, the customer called me and asked about my engineers' location. My engineers just left the site once they had completed the job. They did not report to the person in charge at the site. The customer had not been briefed on what they had done, what was the status of the machine or anything." CS1E2 (46, Director)*

It is also reported by the employers that verbal communication nowadays is not limited to face-to-face meetings or through phone calls; rather, it has evolved to new approaches, such as communicating using new technology such as Skype meetings, WhatsApp calls, Facebook and other phone or computer applications, all of which also require verbal interaction.

> *"Nowadays with the enhancement of technology, we say that besides using email we utilise mediums such as Skype – video calls, WhatsApp*

calls and Facebook and Messenger, so we can monitor their progress from time to time." CS1E5 (37, Technical Manager)

c. Teamwork Skills

Designing and assembling machines, servicing and repairing the equipment are the core businesses for all employers in this case study. The employers state that these tasks are mostly completed in groups. Helping and covering each other's backs, whether in the office or on site are the main attributes required by most of the employers when referring to teamwork skills.

> *"They cannot work on their own. In offshore sites we have the 'Buddy System' where we need to work with a minimum of two personnel." CS1E1 (33, Technical Manager)*

> *"In this company, we welcome the personnel helping and co-operating with each other, no matter the difference in background or discipline." CS1E2 (46, Director)*

Similarly, CS1E5 shares his experience of when his engineer requires help from the team in Malaysia when working at the overseas site:

> *"... Let's say if your colleague is having trouble at an overseas site, he may not have a particular skill, he can just hook up on online, get the open line for us and access remotely from Malaysia to help him." CS1E5 (37, Technical Manager)*

CS1E3 also adds that efficient teamwork can be developed if the team has properly planned the tasks that have to be executed.

> *"For example, I want them to perform the Preventive Maintenance (PM) tomorrow, but by today they need to prepare the planning. They also need to explain to me what time they want to take action, how they want to perform it, whether or not the spare parts are in stock, whether or not the parts are available locally or need to be ordered from overseas. If it is local then it should be fine, but if it is from overseas then the PM will be delayed, and so on." CS1E3 (35, Automation and Project Manager)*

Another attribute of teamwork reported by the employers is that they are able to follow their superior's or group leader's instructions.

> *"... Obey the instructions that we have given to them. For example, if we gave them one instruction, they must follow without arguing." CS1E2 (46, Director)*

> *"We just instruct them; you should do this and this and they can execute it efficiently without creating other problems." CS1E4 (35, Head of Engineering and Services)*

Being aware of individual and other team members' tasks is also a highlighted attribute that represents teamwork skills.

> *"Both of the partners in the team will have to make they are aware of each other tasks." CS1E3 (35, Automation and Project Manager)*

Working in a team requires each of the team members to be able to contribute ideas during group discussions.

> *"… Always contribute ideas during discussions." CS1E2 (46, Director)*
>
> *"I would like everyone to actively communicate, fight to give ideas, discussing, this is what I want." CS1E4 (35, Head of Engineering and Services)*

The employers also require their engineers to be able to work with other people, regardless of age and experienced, whether they are colleagues or people outside the company.

> *"... Work and communicate with the seniors who are much older than you and have more experience." CS1E3 (35, Automation and Project Manager)*
>
> *"... We need to collaborate with whoever we are working with." CS1E5 (37, Technical Manager)*

However, CS1E3 has experienced difficulties when grouping the young engineers with a senior engineer. It seems that they cannot co-operate with each other.

> *"Sometimes what I realise is that age has some effect on their relationships. If they are the same age they can perform well and get along together, but when I group them with the seniors who are in their 40s, it becomes awkward for them." CS1E3 (35, Automation and Project Manager)*

CS1E2, CS1E4 and CS1E5 claim that the size of the group depends on the complexity of the job and also the operating costs. According to CS1E3 and CS1E5, it is important to arrange the group based on individual capabilities and interests, which CS1E1 describes as creating a "dynamic team".

> *"I divide them based on their capabilities." CS1E3 (35, Automation and Project Manager)*
>
> *"You know what your guy can do; you just give them instructions to do the things that he is good at. No point in giving instructions on something that he cannot do. You are racing against time." CS1E5 (37, Technical Manager)*
>
> *"... In my team I need to have the trouble shooter, the problem- solver and the personnel who can support them. That is how I ensure the team stays dynamic." CS1E1 (33, Technical Manager)*

Most of the employers also report that teamwork has become one of the main criteria during yearly appraisals. The assessments are based on the supervisor's or superior's observations of the engineer when performing tasks.

> *"On teamwork assessment, we will ask their supervisor or the senior technician. They will provide us with the input of whether or not they make a good team member, because the project will be handled by 3 persons: the supervisor and two technicians, that is why teamwork is critical." CS1E1 (33, Technical Manager)*
>
> *"It will be included as their KPI so it will affect their performance, bonus, increment on the salary and so on." CS1E3 (35, Automation and Project Manager)*

Time is also used as an indicator, which some employers call a benchmark on which to assess teamwork effectiveness.

> *"Second, it is about timing. If the teamwork is good, then the time to perform the wet test is lesser." CS1E1 (33, Technical Manager)*
>
> *"The fastest team who does their job with great quality is the efficient team." CS1E3 (35, Automation and Project Manager)*

4.4.4 Summary of Employers' Expectations of Graduates' Generic Skills Attributes

The employers' perceptions of PBL graduates' generic skills are shown in Table 4-14 (refer to Chapter 4.4.2).

Table 4-14 Employers' perception of PBL graduates' generic skills (Source: author)

<table>
<tr><th colspan="2">Description</th><th>Perception</th></tr>
<tr><td colspan="2">Further generic skills training</td><td>Not provided – time and cost</td></tr>
<tr><td colspan="2">Technical vs generic skills</td><td>Both are important</td></tr>
<tr><td rowspan="3">Strengths</td><td>Technical knowledge and skills</td><td>Good</td></tr>
<tr><td>Generic skills</td><td>Good problem-solvers, excel in critical thinking and are able to work in a team.</td></tr>
<tr><td>Others</td><td>Independent, able to follow instructions.</td></tr>
<tr><td rowspan="4">Weaknesses</td><td>Graduates' qualities</td><td>Decreasing</td></tr>
<tr><td>Verbal communication skills</td><td>Failure to update progresses, poor English-speaking skills and failure to explain a subject briefly.</td></tr>
<tr><td>Academic result does not represent generic skills performance</td><td>Yes</td></tr>
<tr><td>Others</td><td>Expectations of high starting salaries.</td></tr>
</table>

Recommendations	Expose the students and lecturers to industry problems, establish collaborations with industry.

All in all, the findings for generic skills attributes for the workplace, as established from the employers' interviews, can be summarised in Table 4-15 (refer to Chapter 4.4.3).

Table 4-15 Summary of employers' descriptions of graduates' generic skills attributes (Source: author)

Generic Skills	Attributes Description
Problem-solving	Solving problems within the time and funds, objective focus, macro perspective, understanding the problem, finding the cause and solution (thinking, talking and deciding), being creative, having contingency plans, independent, acknowledging superiors, being resourceful, minimising errors, and handling and managing situations.
Verbal Communication	Presenting, reporting, interacting with multi-(disciplinary/race/level/nationality) personnel, discussing, understanding customers' needs, convincing, negotiating, conversing fluently using the English language, being multilingual, maintaining good relationships with customers, communicating verbally via social networks, voicing opinions.
Teamwork	Co-operating, giving and obeying instructions, sharing ideas, completing tasks quickly to a good standard, delegating tasks, being aware of individual and other members' task, updating on progress, being supportive.

An example from one of the employer's transcripts is available in **Appendix 5C**.

4.5 Summary

This chapter describes the first case study (in a PBL environment) conducted in one of the HE institutions in Malaysia. The qualitative research is employed through semi-structured interviews involving three stakeholders (seven lecturers, eight students and five employers). The objective is to explore the existing methods of assessing generic skills within an AL environment in Malaysian Higher Education institutions. The next section presents the second case study, looking at a different active learning environment – Work-Based Learning (WBL). The researcher hopes this offers a contrast in situations, probably in standards, cultures and habits, reflecting to the institutional domains.

Table 4-16 First case study (PBL) curriculum alignment matrix (Source: author)

Generic Skills	Intended Learning Outcomes	Learning Activities	Assessment Tasks and Assessment Criteria				
At the end of this module, students should be able to:			**Presentation**	**Informal Peer Assessment**	**Demonstration**		
1. Communication (oral/verbal)	Present and demonstrate the project design, operation and functionality to the internal and external verifiers.	• Demonstration • Presentation	Use of language, Use of media, Expression, Contents, Explanation, Question & answer				
2. Problem-Solving	Test, debug, troubleshoot and commission the project accordingly.	• Discussion • Project implementation • Presentation • Question & answer	Question & answer				
3. Team Working	Apply good industry practices in teamwork.	• Presentation • Discussion • Question & answer	Team effort, Co-operation	Fairness, Satisfaction	Team effort, Co-operation		

5 Case Study 2: Generic Skills Assessment (GSA) within a Work-Based Learning (WBL) Environment

5.1 Introduction

This case study focuses on generic skills assessment within a WBL environment. It should be noted that, within this case study, knowledge providers are known as mentors. The mentors are not the HE institution's personnel. Rather, the mentors work as engineers or assistant engineers with one of the concession companies that are appointed by the government to train the WBL students. However, the mentors' role in educating the students is the same as the lecturers in the HE institute. WBL is conducted in four government hospitals around the South of Malaysia, involving three states: Johor (Sultanah Aminah Hospital – SAH and Sultan Ismail Hospital – SIH), Melaka (Melaka Hospital – MH) and Negeri Sembilan (Tuanku Jaafar Hospital – TJH). The students are picked from the three states under the WBL coordinator's supervision, whereby the coordinator came from one of the concession companies. This company is responsible for maintaining and repairing Bio-Medical equipment within the states. More information with regards to the WBL process and implementation is given in the next few sections.

This case study has similar aims and is conducted using similar methods (semi-structured interviews and course documents) as in the previous chapter. The discussion is developed through the findings and analyses from the three groups of participants. Firstly, this chapter presents findings of the current implementation and the challenges of engineering mentors when assessing students' generic skills within the WBL environment. Essentially, the data presents the mentors' reflections on their careers, teaching approaches and their generic skills assessment practices. Secondly, the chapter presents the data collected and its analysis from the students' interviews. This basically provides further information about the students' experiences of generic skills assessment, its development, and the regular learning and teaching practices employed by the mentors. The findings from the employers' interviews represent the industry's reflection on current and previous graduates' generic skills performance, and the employers' expectations of those skills after HE learning. Any differences of agreement between both mentors and students in terms of understanding the assessment process (in HE practice) with the industry's expectations of the generic skills attributes are discussed further in the summary section. The research framework of the second case study is presented as shown in Figure 5-1. This is the hierarchy that has been determined and used as a basis for the researcher's ongoing discussion on his findings.

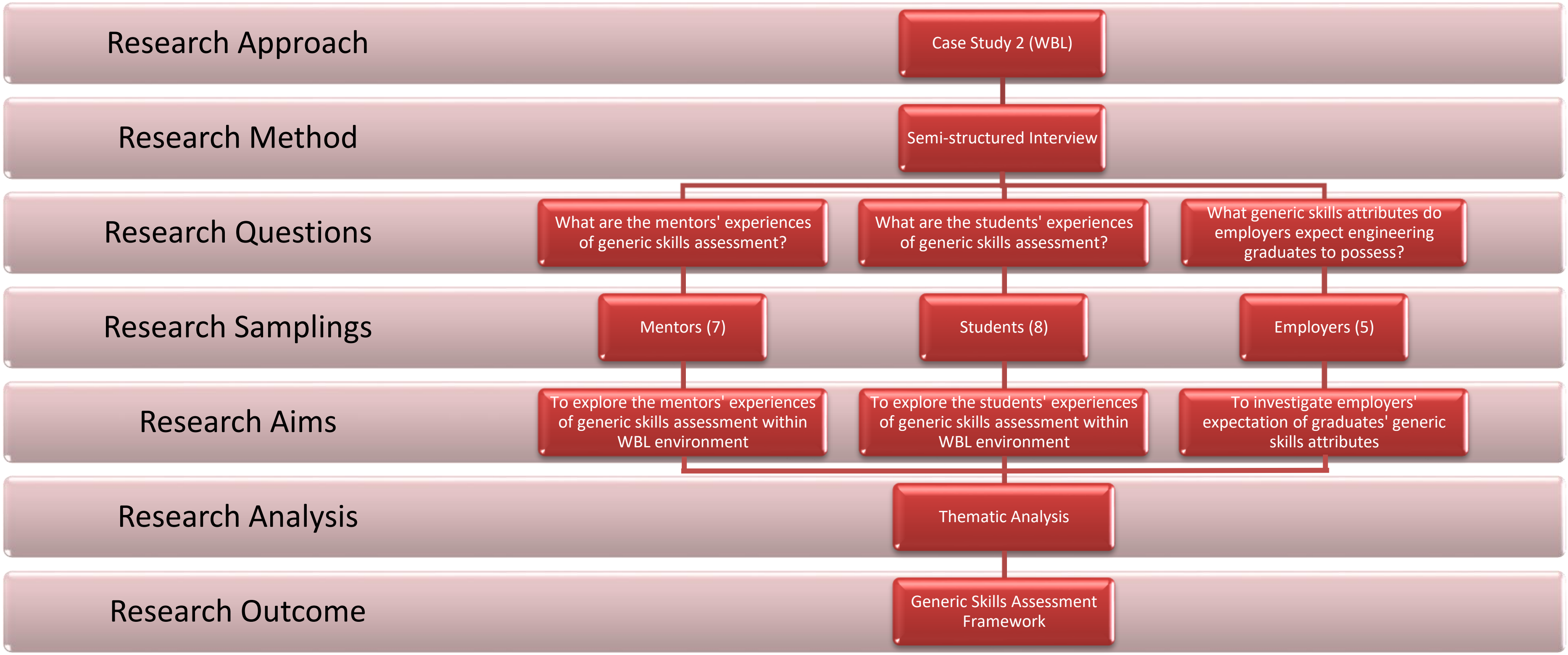

Figure 5-1 Research framework – Case Study 2 (Source: author)

5.2 Findings of Mentors' Experiences of GSA within a WBL Environment

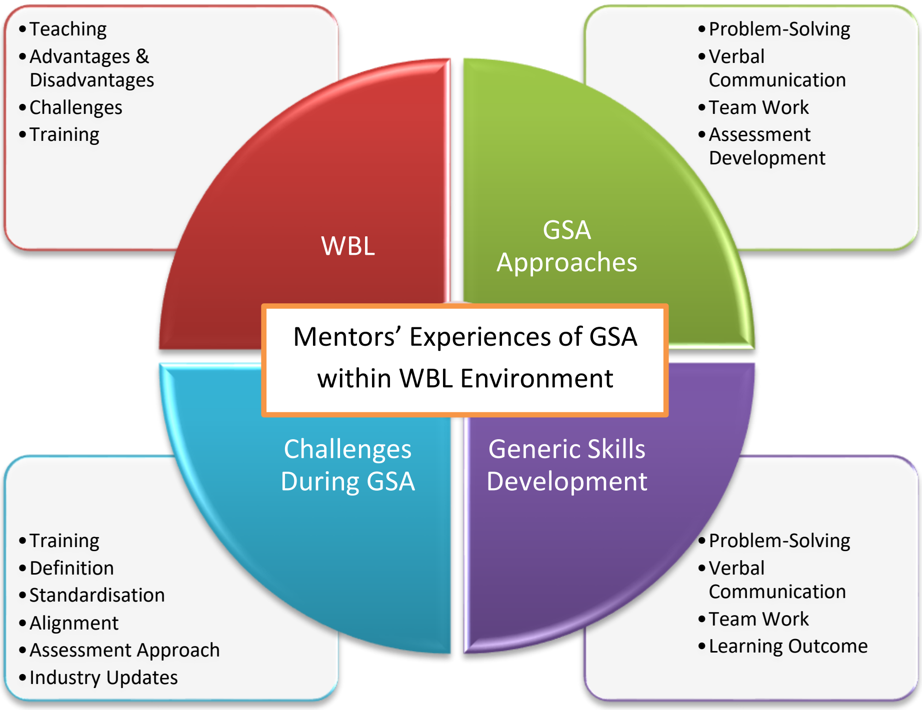

Figure 5-2 A Summary of the mentors' experiences of GSA within a WBL environment main themes (Source: author)

As with the first case study, the same characteristics are briefed to the WBL programme coordinator (company), Mr Abdul. Based on the given characteristics, he selects seven Bio-Medical Electronics Engineering mentors, who have completed pedagogy training and have experience assessing generic skills within the WBL environment, to be interviewed by the researcher. The mentors' geographical locations are also considered in this case study. This is to provide concrete proof whether or not the WBL implementations in each of the locations are standardised. The methods used to collect and analyse the data are the same as the first case study. The outcome from the analysis is identified using four keywords (themes) that emerge from the scripts as shown in Figure 5-2; WBL, generic skills development and assessment, and its challenges. All the themes that emerge are discussed after the next section.

5.2.1 Mentors' Background

This section presents the mentors' brief biographies. All the participants' names are created and known only to the researcher. Table 5-1 shows that all the participants are male except for CS2M3 who is the only female respondent participating in this case study. Further information of the respondents' profiles is presented in Figure 5-3, Figure 5-4, Figure 5-5 and Figure 5-6.

Table 5-1 Mentors' biographical background (Source: author)

Participant	Biographical Background
Case Study 2	
CS2M1	He is a 27-years-old male. He possesses a degree in Bio-Medical Engineering. He joined this company in 2011. He has 2 years of experience as a mentor and 3 years of industry experience. He is currently Head of Mentors in TJH.
CS2M2	He is a 38-year-old male. He has been working in this company for the last 10 years with a Higher National Diploma (HND) Electrical Electronics qualification. Currently, he is assigned to TJH. He has 3 years' experience as a mentor and has been in the Bio-Medical industry for 17 years.
CS2M3	A 25-year-old female mentor. Her highest qualification is a HND in Bio-Medical Electronics. She has a year of experience as a mentor and has 2 years of experience in this company. Currently she is the Head of Mentors in MH.
CS2M4	A 35-year-old male. He has only a year of experience as a mentor but has 15 years of experience working in Bio-Medical industries. He has been placed in MH since 2005.
CS2M5	He is a 27-year-old mentor. He possesses a HND in Bio-Medical Electronics from one of polytechnics in Malaysia. He has 6 years of experience working in the industry and 4 years of experience as a mentor. He is a colleague of CS2M3 and CS2M4 in MH.
CS2M6	A 25-year-old male. He joined this company in 2012 and was placed in SAH since then. He graduated with a HND in Bio-Medical Electronics. He has only 2 years of industry experience and 1 year of experience as a mentor.
CS2M7	He is a 25-year-old male. Similarly, he possesses a HND Bio-Medical Electronics from a local polytechnic. He has 1 year of experience as a mentor and 2 years' working in the industry. He is working in SAH.

Note: The year in which the data is collected is 2014.

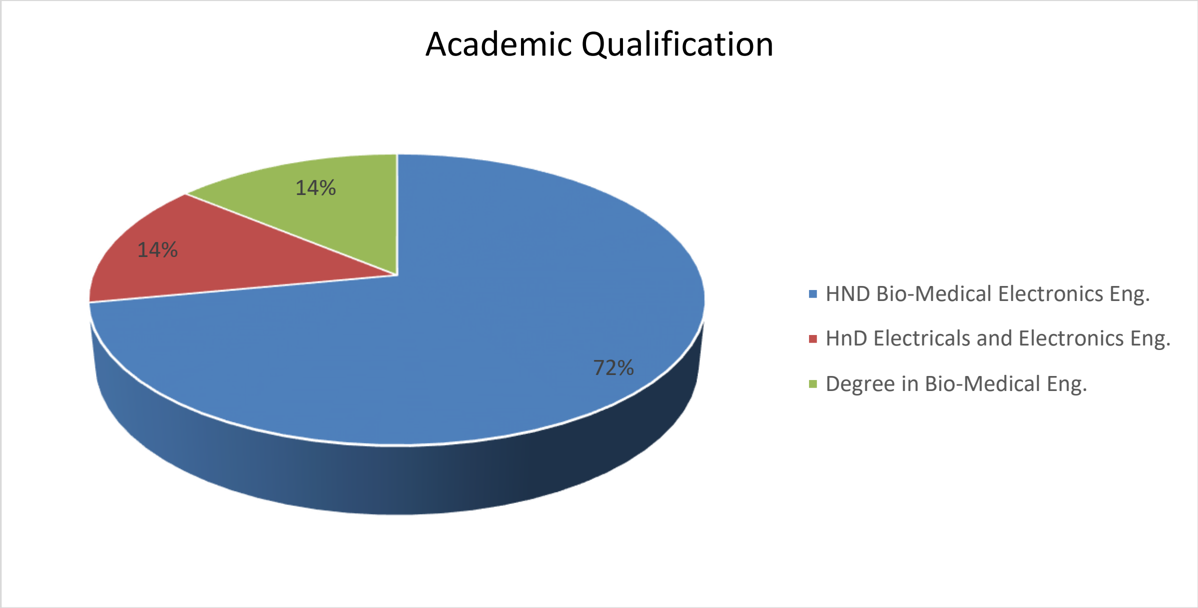

Figure 5-3 Mentors' academic qualifications (Source: author)

From the interview transcripts, the majority of the mentors participating in this case study have the qualification of a HND in Bio-Medical Electronics Engineering (72%) as shown in Figure 5-3. Only one of the mentors possesses a degree in Bio-Medical Engineering (14%).

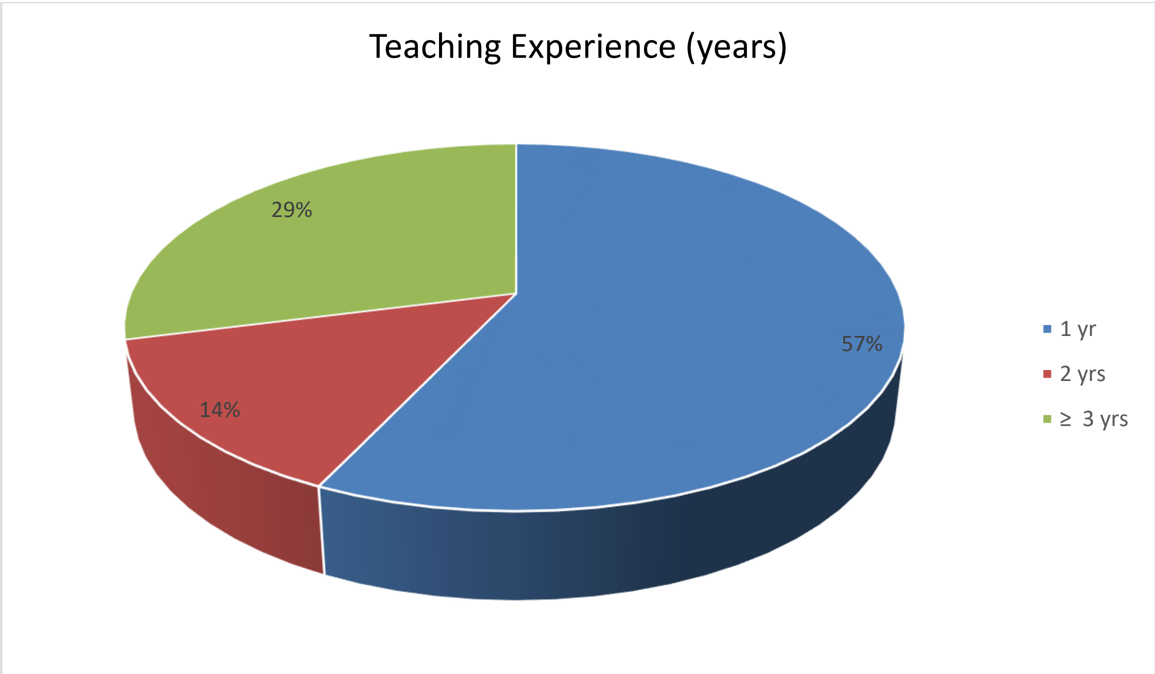

Figure 5-4 Mentors' experience in teaching (Source: author)

As displayed in Figure 5-4, only two mentors have teaching experience of more than three years (29%), while the majority of the mentors only had a year of experience (57%). All of the mentors are responsible not only for guiding the students' learning but are also required to perform essential tasks either as an assistant engineer or an engineer in the company. The researcher also identifies that all of the mentors who had only a year of experience in teaching are WBL graduates. Being experienced as a WBL student previously has increased their confidence and knowledge to become a mentor. CS2M3, for example, describe briefly her experience from both perspectives: as a student and a mentor.

> *"When I was a WBL student, I usually observed how my mentor works because I am not allowed to repair or do the maintenance alone at that time. Everything that I want to do, I must inform or ask permission from the mentor first. At the same time, I need to learn the procedures in performing the tasks, safety precautions and so on. As a student, I need to make myself aware of those matters. But when I became a mentor, I need to have proper planning for my work, to be able to repair and maintain the equipment by myself and at the same time guide the students' learning, to make sure that I am able to make a decision when needed and need to explain to the students at their level." CS2M3 (1 year of teaching experience, 2 years of industry experience, MH)*

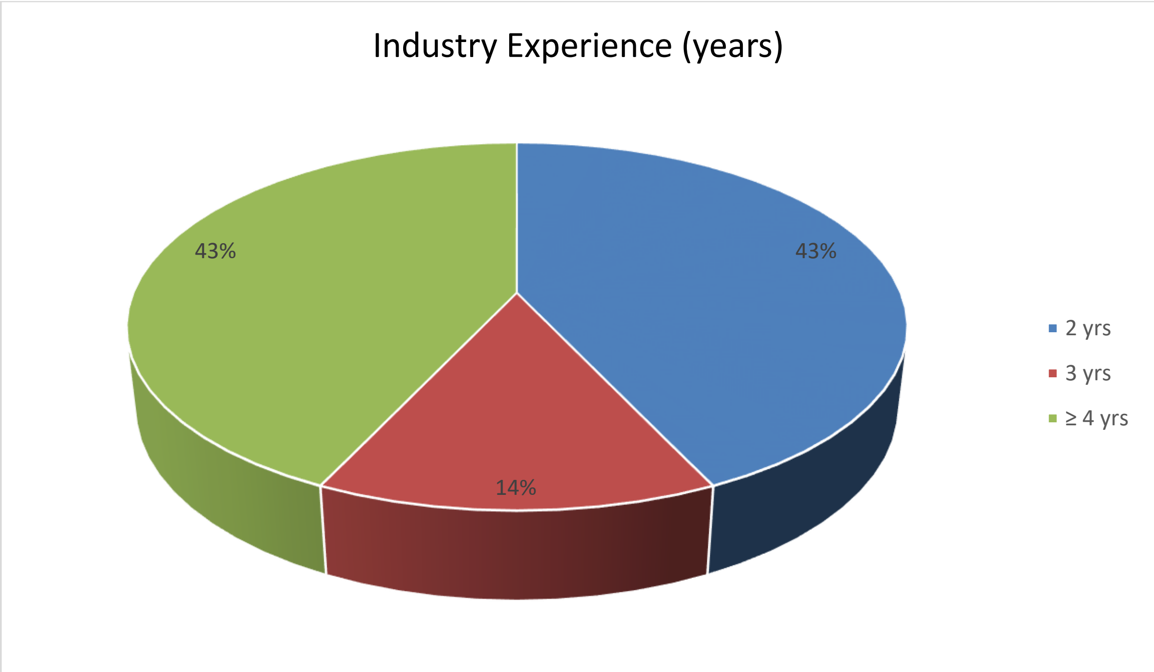

Figure 5-5 Mentors' experience in the industry (Source: author)

Figure 5-5 displays that only one mentor has three years of industry experience (14%). It also shows that 43% of the mentors have two years and more than five years of experience in the industry.

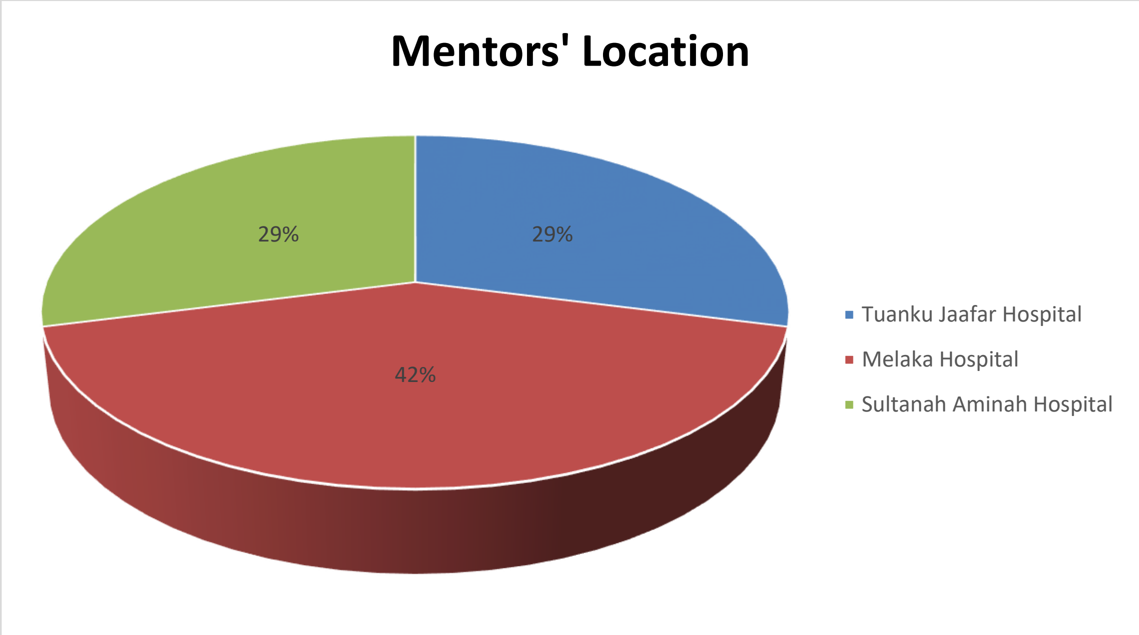

Figure 5-6 Mentors' location (Source: author)

The mentors' semi-structured interviews are conducted in three different locations. Three of the mentors (42%) are interviewed in MH, while two mentors are interviewed in TJH (29%) and SAH (29%) respectively as shown in Figure-5-6.

5.2.2 Mentors' Teaching Practices within WBL

Before going any further with the findings, it is crucial to understand the mentors' essential tasks in this case study. It is acknowledged by the mentors that there are five departments available in all the hospitals, namely: The General department, the Critical Care department, the Lab department, the X-Ray department, the Dental department and the Surgical department. They also inform that, besides mentoring the WBL students, each of the mentors are responsible for handling, maintaining and repairing the Bio-Medical equipment in the General department and in another one of the departments.

This section presents the mentors' reflections of the WBL implementation. The reflections are important to further understand the mentors' experience with their approach towards the WBL practice in the industry. Three keywords (categories) emerge from the mentors' transcripts: **WBL awareness, WBL process** and **students' learning** in WBL. According to the mentors, these are the factors which explain their teaching practice within WBL. This is explained in more detail in the appropriate sections that follow.

a. WBL Awareness

After they attended three days of pedagogy training, all the mentors' report that they are required to attend one day of WBL training in the institute before being assigned to mentor their mentees. CS2M1 and CS2M3 shares the contents of the training that included: understanding the mentors' role, the WBL process, and the syllabus that needs to be covered within the one-year training duration.

To accomplish a better understanding of WBL implementation, besides the training, CS2M4 clarifies that there are proper guidelines in written form that are available for the students and mentors to be used as a reference.

> *"In WBL, there are schedules and processes that students and mentors need to follow as a guideline." CS2M4 (1 year of teaching experience, 15 years of industry experience, MH)*

CS2M1 shares his concern about delivering the syllabus, by saying that there is too much content:

> *"Here we have the General department, Critical Care department, Lab department, X-Ray department, Dental department and Surgical department. The WBL students need to cover most of the equipment available in those departments. Frankly, there are quite a lot of things." CS2M1 (2 year of teaching experience, 3 years of industry experience, TJH)*

However, CS2M7 acknowledges that he is responsible for making sure his mentees are able to complete the syllabus according to the schedule.

> *"Another task of mine is to follow up the students' progress, make sure they have completed the syllabus which has been scheduled for them." CS2M7 (1 year of teaching experience, 2 years of industry experience, SAH)*

Other than that, guiding the students' learning and supervising their performance at the sites are among the common answers from the mentors when asked about their roles. Concurrently, in addition to being mentors, they are expected to perform their essential task as an engineer or assistant engineer in the company. CS2M2 and CS2M3 informs the researcher that the mentors should possess good time management so that they are able to balance their responsibilities as a mentor as well as an engineer or assistant engineer simultaneously.

> *"As mentors, we tend to spend too much time in educating the students that at the same time we forget to allocate the remainder of the time to complete our own tasks." CS2M2 (1 year of teaching experience, 17 years of industry experience, TJH)*

> *"When I became a mentor, I needed to have proper planning of my work, to be able to repair and maintain the equipment by myself and at the same time guide the students' learning..." CS2M3 (1 year of teaching experience, 2 years of industry experience, MH)*

If a mentor lacks time management skills, it could affect his/her performance. CS2M4, for example, worries that he may not be able to complete his essential tasks as his tasks are increasing, so he might not be able to guide the students as he expects.

> *"Just imagine our workload: we have only 6 of us to cover 4000 – 5000 assets. We are only talking about the Planned Preventive Maintenance (PPM) not including the Repairing Corrective Maintenance (RCM) yet." CS2M4 (1 year of teaching experience, 15 years of industry experience, MH)*

Likewise, CS2M2 feels that, because of the commitment to educate the WBL students, it has slowed down his work at the site.

> *"Sometimes we need to deal directly and urgently with the users but because of the mentees we need to postpone that meeting." CS2M2 (1 year of teaching experience, 17 years of industry experience, TJH)*

However, CS2M7 has a different perception of this matter. He describes that his mentees have supported him in doing his tasks and indirectly reduced his workload:

> *"Basically the mentee acts as my assistant because you know my workloads are quite high." CS2M6 (1 year of teaching experience, 2 years of industry experience, SAH)*

b. WBL Process

With regards to WBL practice, CS2M3 describes the approach as a structured real-life working experience., It is different from "placement or internship" because of the duration and students' status as hired workers which allows them to work on the site.

> *"In WBL, the students work and learn simultaneously within a whole year. Like other placements, the time is too short to learn a lot of equipment. Another thing is that the rules here do not allow the placement students to be at the site but since WBL is a Work-Based Learning, indirectly, the students have become workers so we have followed the rules and they can be working at the site." CS2M3 (1 year teaching of experience, 2 years of industry experience, MH)*

The mentors' interview transcripts reveal that this case study has partially employed WBL through the Bio-Medical Electronics Engineering Programme since 2010, which only involves final year (third and fourth semester) students. It was introduced to train and enhance students' experiences with authentic scenarios in the curriculum. In this case, the authentic scenarios take place in five main hospitals around the Southern Regions of Malaysia where the students are expected to learn to handle, maintain and repair the Bio-Medical equipment as indicated in the syllabus within one year of working in the industry.

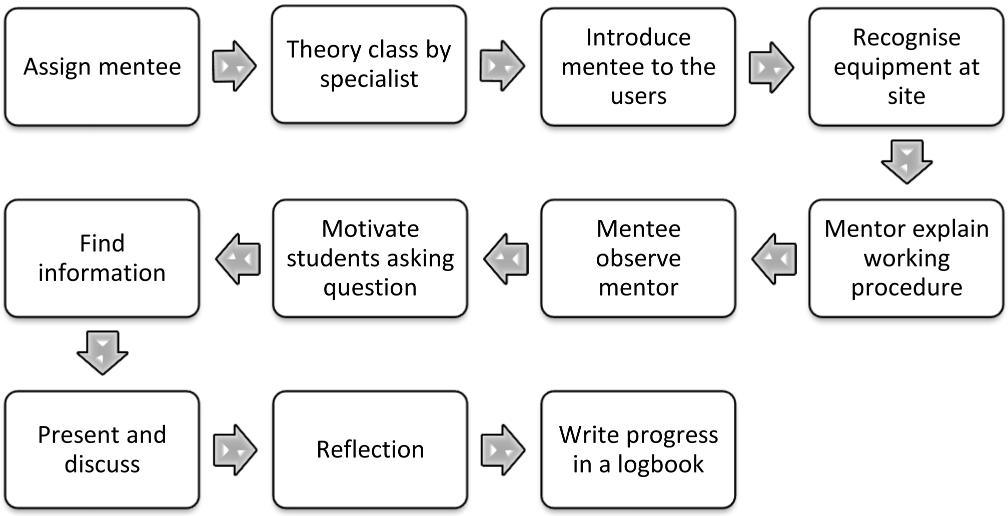

Figure 5-7 Institutional process adapted from mentors' interviews (Source: author)

As displayed in Figure 5-7, the WBL process starts by assigning one mentee/student to one mentor.

> *"… One mentor is only assigned to one mentee to ease the teaching and observation process." CS2M6 (1 year of teaching experience, 2 years of industry experience, SAH)*

Before the students are allowed to enter the hospital site, they need to attend theoretical classes conducted by the specialist. CS2M1 and CS2M2 describe the specialist as someone who is a real expert in handling, maintaining and repairing the specific equipment.

> *"For example, the critical care equipment and we also have a specialist who is responsible for this equipment. He is the one who will conduct the class particularly for the theoretical lessons. They are the experts in repairing and handling the machines." CS2M1 (2 year of teaching experience, 3 years of industry experience, TJH)*

Next, the mentor introduces the mentees to the users at the site. This is to ensure the users know that the students are part of their team. The doctors, staff nurses, matrons, sisters and other hospital personnel are among the users, as reported by the mentors. Students are strictly prohibited from being at the site without their mentors. Mentors sometimes feel uncomfortable being observed as they go about their task.

> *"Sometimes we feel uncomfortable, you know, when people are observing you while you are performing the tasks. You feel a little bit pressured. It really is an awkward feeling." CS2M2 (1 year teaching of experience, 17 years of industry experience, TJH)*

> *"The mentor may feel a bit awkward as someone is watching them doing the work." CS2M1 (2 year teaching of experience, 3 years of industry experience, TJH)*

At the site, the students are expected to recognise the equipment that they have been taught by the specialist in the earlier process. The mentor explains the working procedures and safety measures that need to be applied. CS2M5 expects his mentee to record information in a written format.

> *"I would expect him to write down all the information that I have given to him." CS2M5 (4 years of teaching experience, 6 years of industry experience, MH)*

According to CS2M4 and CS2M7, there are no formal classes to develop the students' technical knowledge and skills on site. The students are expected to observe how the mentors perform their tasks, establish communication and relationships with the users, and complete technical jobs (maintaining and repairing work). Once the knowledge is delivered, the students are required to perform the same practice with their mentor's supervision. In the process, the mentors are constantly encouraging the students to ask questions if they do not understand about the equipment and how the procedures are carried out. The students are also expected to do some research and find out information to answer their own curiosity before presentations are held and further discussion is continued with the mentors.

> *"… We expect them to search from the Internet or manuals and explain it to us the next day." CS2M2 (1 year of teaching experience, 17 years of industry experience, TJH)*

Next, reflections are undertaken to confirm the students' learning, assess their knowledge and improve any weaknesses or limitations they have shown during the process.

> *"… Whatever they did wrong along the learning process will be told to them." CS2M4 (1 year of teaching experience, 15 years of industry experience, MH)*

> *"After the presentations, the staff will give constructive feedback to them to improve their way of presenting and also the contents of the slides." CS2M5 (4 year teaching of experience, 6 years of industry experience, MH)*

The last stage of the WBL process is that the students have to record their learning process in the logbook prepared by the institute.

> *"… The students have to write their report on a daily basis, repairing and troubleshooting procedures, and so on." CS2M3 (1 year of teaching experience, 2 years of industry experience, MH)*

Though the WBL processes are reported to be conducted in such a way by most of the mentors, CS2M4 and CS2M5, however, admit that, due to high workloads, sometimes they have to skip some of the WBL processes.

> *"Sometimes I do admit that I have to skip one or two processes because of the additional workload." CS2M4 (1 year of teaching experience, 15 years of industry experience, MH)*

CS2M2 and CS2M4 tell the researcher that the WBL processes are monitored by the WBL coordinator. The coordinator is assigned to guide and remind mentors of their progress.

Most of the mentors think that WBL is a good approach for learning, where the students are exposed to the equipment and experience solving authentic problems in industry. CS2M5 and CS2M1, for example, describe WBL as unique, because it incorporates what is learnt from theoretical classes conducted by the specialist while in industry. CS2M5 further explains, besides establishing the students' understanding, the approach also helps the students to develop technical and generic skills. Other than that, CS2M2 has experience where students ask questions which are beyond his knowledge. This has motivated him to increase his knowledge and he admits that sometimes he learns something new from the students throughout the process. According to CS2M4, most of the WBL students are offered a job in the company once they have completed their studies.

> *"Another advantage is that once they complete their WBL, they are offered a job right away. All the knowledge and skills that have been developed is still fresh in their minds." CS2M4 (1 year of teaching experience, 15 years of industry experience, MH)*

c. Students' Learning

CS2M2, CS2M5 and CS2M3 briefly comment that the students' learning process mostly happens within three scenarios: during Diagnostic and Observation (D&O), Planned Preventive Maintenance (PPM) and Repairing Corrective Maintenance (RCM). They further clarify that D&O is held when the specialist conducts the class on specific equipment as stated in the syllabus. Basically, the specialist explains basic knowledge; for example, the operation, how to handle the equipment and its common faults. At the end of the D&O, technical assessment is conducted through tests to reflect the students' understanding of the equipment.

> *"It is handled by the specialist. They will explain briefly about the machine and, at the end of the D&O, the specialist will conduct a test. This is to verify the students' knowledge on the specific machine." CS2M6 (1 year of teaching experience, 2 years of industry experience, SAH)*

The PPM is conducted based on what the company has planned throughout the whole year. Basically it requires the mentors and the students to perform standard procedures to maintain specific equipment. RCM, on the other hand, is conducted based on the customers' reports of faulty equipment. In this case, the mentors and students need to be able to identify the faults and repair the equipment within the time given. These tasks require both mentors and students to acquire good knowledge, and be extra careful in making sure that the equipment is reliable to be used, as some of them are used to monitor and diagnose patients' diseases. CS2M7, for example, prefers his mentee to attend PPM before he allows his mentee to conduct the RCM.

> *"… It is hard to teach during RCM if the students don't have basic knowledge of that equipment, so what I do is ask my mentee to follow other mentors or staff who are conducting the PPM for two or three days so that they to get to know and can familiarise themselves with the equipment, how it functions, the flow of the machine process and so on. Once they have the knowledge, only then will I bring them to the site for RCM work." CS2M7 (1 year of teaching experience, 2 years of industry experience, SAH)*

CS2M1 shares his experience in guiding the students' learning. First, he explains basic knowledge of the equipment, what the common problems are that the equipment has, how to trouble shoot and what procedures need to be taken to maintain and repair the equipment. In addition to the specialist giving a lecture on specific topics and equipment, students develop their knowledge and skills by themselves or through experience with their mentor on site. CS2M3 claims that WBL offers authentic experience for students' learning. CS2M4 also highlights the importance of gaining experience.

> *"Nowadays, it requires the students to experience things for themselves in order to understand things easily." CS2M4 (1 year of teaching experience, 15 years of industry experience, MH)*

Similarly, CS2M2 emphasises the importance of sharing his knowledge and offering students experience working in a real industry environment.

> *"The knowledge that I have gained throughout my life, I would like to share it with the young generation because I know the students need to experience it by themselves before they can work later in the future." CS2M2 (1 year of teaching experience, 17 years of industry experience, TJH)*

CS2M6 and CS2M7 acknowledge that, to be a good mentor, they should provide more opportunities for students to learn the things that are practised in the industry.

> *"As I am aware, my responsibility is more or less to provide the students with more opportunities to learn technical work while at the*

site" CS2M6 (1 year of teaching experience, 2 years of industry experience, SAH)

Most of the mentors realise that WBL requires students to be active in their learning so that they benefit from the approach.

> *"I can see the WBL students becoming more active and have benefitted from the approach where they have learnt a lot of things..." CS2M1 (2 year of teaching experience, 3 years of industry experience, TJH)*

> *"I think it depends on the individual student. If he/she has a very good attitude, is active and hardworking, he/she will get more benefits from this approach. It is easier for them to learn." CS2M2 (1 year of teaching experience, 17 years of industry experience, TJH)*

Besides acquiring technical skills, most of the mentors constantly report that the students also develop their generic skills. Being able to solve problems during RCM and being able to establish good relationships as well as direct communication with the users, mentors and other personnel are among the common generic skills reported to have been developed throughout the WBL approach.

5.2.3 Generic Skills Development

This section presents the findings of how generic skills, namely: problem-solving, verbal communication and teamwork are developed within the WBL environment from the mentors' perspective. It is important for the researcher to understand the activities involved, how the skills are developed and, later, provide evidence of whether or not such activities are considered during assessment and map with the intended learning outcome.

a. Problem-Solving Skills Development

As explained earlier, the WBL nature of the environment requires students to solve problems, especially during RCM. Once the students have observed their mentors performing the repairing procedures, they are expected to conduct the same procedures when the same problem occurs in the future at the site.

> *"The students are expected to trouble shoot and repair the same equipment in the future." CS2M1 (2 years of teaching experience, 3 year of industry experience, TJH)*

> *"… We will guide the students on the procedures, where to start and how to focus." CS2M2 (1 year of teaching experience, 17 years of industry experience, TJH)*

> *"… The next time the same problem occurs; I will ask them to solve it in front of me." CS2M5 (4 years of teaching experience, 6 years of industry experience, MH)*

However, according to CS2M1, sometimes he has to take over the task due to time limitations as well as to avoid getting a penalty from the hospital.

> *"We can't drag the work on for too long as we need to minimise the break down time or else we will get a penalty from the user." CS2M1 (2 year of teaching experience, 3 years of industry experience, TJH)*

Similarly, CS2M6 requires the students to be creative in solving problems to reduce costs.

> *"If it is not necessary to change to new parts, we can always modify them, as this would minimise our repairing costs." CS2M6 (1 year of teaching experience, 2 years of industry experience, SAH)*

Other activities of problem-solving development include students being trained to acquire the ability to identify and verify faults in the equipment.

> *"The students are taught to identify what is the problem, for example error code in HDU, and where it leads us to." CS2M3 (1 year of teaching experience, 2 years of industry experience, MH)*

Most of the mentors prefer to give their mentee some flexibility to work alone and with less supervision.

> *"Once the mentor feels that their mentee has developed confidence, then we can let them work alone with minimal supervision. Basically after that we treat them as a worker and not as a student anymore." CS2M3 (1 year teaching of experience, 2 years of industry experience, MH)*

> *"When I feel confident enough that they can work independently, then I will ask them to work alone by themselves." CS2M5 (4 years of teaching experience, 6 years of industry experience, MH)*

CS2M3 and CS2M6 describe the approach as independent working:

> *"We prefer to have students who can trouble shoot and repair on site, solve the problems by themselves and not rely on the mentors or other staff." CS2M3 (1 year of teaching experience, 2 years of industry experience, MH)*

> *"… Whether they can solve the problem by themselves or they still need help from others. Usually after being trained for 6-7 months, we can rely on them without our supervision at all." CS2M6 (1 year of teaching experience, 2 years of industry experience, SAH)*

Likewise, CS2M4 expects his mentee to try other alternate ways of finding a solution before giving up and asking him for help.

> *"I would expect them to try a few solutions before they come back to me and ask for my help." CS2M4 (1 year of teaching experience, 15 years of industry experience, MH)*

It is reported by most of the mentors that they require students to find further information from multiple sources when solving the problems.

"They can either check it through the Internet, manuals or may be ask directly the person who asked the question in the first place." CS2M6 (1 year of teaching experience, 2 years of industry experience, SAH)

"… We expect them to search the Internet or manuals." CS2M2 (1 year of teaching experience, 17 years of industry experience, TJH)

b. Verbal Communication Skills Development

Most of the mentors prefer their mentee to report verbally on their progress of work and learning.

"I prefer for them to do it verbally because it is easier and I can have a two-way communication with them. If it is just in written form, if the report is not so brief, then I might need to ask them to explain it to me again so it will be a waste of my time." CS2M4 (1 year of teaching experience, 15 years of industry experience, MH)

"If I did not manage to ask them in the evening, I will follow up with them the next morning, so that they explain to me their progress, what they have done previously." CS2M5 (4 years of teaching experience, 6 years of industry experience, MH)

"If my mentee follows other staff or mentors, I will make sure that, before he clocks out from work, I get the chance to ask him what he has learnt today." CS2M6 (1 year of teaching experience, 2 years of industry experience, SAH)

WBL students are expected to present their daily progress in turn (one student per day), before all the technical personnel go to the site every morning. According to CS2M2, the presentations are held to update the WBL students' knowledge with what they have learnt on the previous day.

"… There is one session where we expect one of the WBL students to present and explain about any equipment which they want to share with all the staff." CS2M2 (1 year of teaching experience, 17 years of industry experience, TJH)

At the end of the presentation, the technical personnel are given the opportunity to ask questions and provide comments to the students.

"After the presentation, there will be a question and answer session so everyone can ask questions and the student needs to be able to answer them." CS2M1 (2 years of teaching experience, 3 years of industry experience, TJH)

"At the end of the session, the staff will ask questions and give their comments on the content of the presentation." CS2M2 (1 year of teaching experience, 17 years of industry experience, TJH)

In addition to the daily presentation, the students are expected to conduct two presentations at the end of the semesters.

"… The project presentation is what we call here a TAR – Technical Assessment Report in semester 3 and EI- Engineering Improvement, which is conducted in semester 4." CS2M3 (1 year of teaching experience, 2 years of industry experience, MH)

This process helps students to develop their skills and confidence in conducting presentations in front of an audience.

"The objective is to make the students feel familiar with giving a presentation in front of people." CS2M2 (1 year of teaching experience, 17 years of industry experience, TJH)

"It is an opportunity for them to improve their presentation skills and build their confidence when presenting in front of people." CS2M5 (4 years of teaching experience, 6 years of industry experience, MH)

From the mentors' interview transcripts, it is clear that most of the time on site the students have to establish direct communication with the users.

"… Our environment of work requires them to talk, explain and communicate with users, staff members, mentors and sometimes even with the vendors." CS2M6 (1 year of teaching experience, 2 years of industry experience, SAH)

According to CS2M2, CS2M1 and CS2M4, most of the students converse in the Malay language throughout the process.

"Most of the time we want the students to converse using Malay and sometimes mixed. They will converse in English when they want to use engineering terms." CS2M2 (1 year of teaching experience, 17 years of industry experience, TJH)

CS2M5 claims that it is time-consuming for students to get to know the users. However, almost all of the mentors suggest that the students must first identify the users' personalities and interests before further interaction can be held.

"… The students have to get to know the users' personalities and interests, and from there they will learn the way to communicate with the users individually." CS2M1 (2 years of teaching experience, 3 years of industry experience, TJH)

"… Because users also have their own personalities. Some users are easier to approach but some get angry more easily, so the students need to know with whom they are dealing." CS2M2 (1 year of teaching experience, 17 years of industry experience, TJH)

"Here, different users have different kinds of personalities, some are easy to get along with and some are quite strict with the protocols." CS2M7 (1 year of teaching experience, 2 years of industry experience, SAH)

Similarly, CS2M3 and CS2M7 want students to be able to recognise the users' rank. They share their experiences of when their mentee was not able to address the user's rank appropriately:

> *"It happened before when one of the students addressed a matron as a staff nurse, so the matron gets mad saying: 'I am a matron, why did you refer to me as a staff nurse?' so I had to calm her down and explain the situation." CS2M3 (1 year of teaching experience, 2 years of industry experience, MH)*

> *"If the user is a matron, then we should not call her a sister. If you see a sister, you refer to them as staff nurses. They are quite sensitive if we wrongly address them." CS2M7 (1 year of teaching experience, 2 years of industry experience, SAH)*

The working environment involves a lot of maintenance and repairing work. It requires high interaction and toleration from both parties, both users and technical personnel. For that reason, CS2M3 and CS2M4 highlight the importance of students being able to explain and convince the users briefly and clearly.

> *"… Able to explain fundamental information about the equipment to us and especially when the users have questions about it." CS2M3 (1 year of teaching experience, 2 years of industry experience, MH)*

> *"For example, when dealing with the users, we need to convince them what and why we are doing such and such." CS2M4 (1 year of teaching experience, 15 years of industry experience, MH)*

However, based on his colleague's experience, CS2M7 suggests that students do not disclose too much information to users, as some of it is confidential.

> *"My colleague is just concerned with the fact that maybe his mentee wrongly explains or says things that he shouldn't to the users. In my environment of work, sometimes you don't need to disclose everything to the users, I would say some things are confidential." CS2M7 (1 year of teaching experience, 2 years of industry experience, SAH)*

In situations, such as when they need to replace parts or ask for extra time for repairs to be completed, CS2M4 further emphasises the importance of maintaining good relationships with the users.

> *"… We have established good relationships with the users, usually they will not state a repairing date and time so it gives us some time for us to respond. If you want to keep this privilege, you need to maintain the trust given by the users." CS2M4 (1 year of teaching experience, 15 years of industry experience, MH)*

Similarly, the mentors claim that the students' negotiation skills are very important to satisfy the users' needs:

> *“Negotiations taking place after completing the job can be tricky…” CS2M3 (1 year of teaching experience, 2 years of industry experience, MH)*

> *“The knowledge of how to negotiate with users is critically important so that the users accept and understand what the students are saying.” CS2M7 (1 year of teaching experience, 2 years of industry experience, SAH)*

> *“… It indicates how good my mentee’s levels of negotiation skills are with the users.” CS2M6 (1 year of teaching experience, 2 years of industry experience, SAH)*

According to CS2M5, sometimes both he and his mentee need to repair equipment via a phone conversation with the specialist:

> *“Sometimes he is busy and cannot come to the site, so we need to call him and try to solve it through phone calls.” CS2M5 (4 years of teaching experience, 6 years of industry experience, MH)*

c. Teamwork Skills Development

According to CS2M2, in this case study, WBL offers fewer activities to develop teamwork skills.

> *“So far we aren’t concerned with the students’ teamwork.” CS2M2 (1 year of teaching experience, 17 years of industry experience, TJH)*

However, most of the activities involved to develop the students’ teamwork skills, as reported by the other mentors, include working together in a team to solve problems, especially during RCM.

> *“Sometimes the students need to follow the mentors in two or three groups; during that time, they may work in a team to solve the problem.” CS2M1 (2 years of teaching experience, 3 years of industry experience, TJH)*

> *“Basically, it somehow requires them to work as a team and try to solve the problem together by communicating with each other.” CS2M3 (1 year of teaching experience, 2 years of industry experience, MH)*

According to CS2M1, WBL students are expected to be able to listen to the instructions given by the mentors. Besides that, willingness to share knowledge and helping others are among common activities reported by the mentors.

> *“Let’s say a student is in Lab department. Is he/she willing to share his/her knowledge to the others, help and guide the others to repair the equipment that he/she is familiar with?” CS2M3 (1 year of teaching experience, 2 years of industry experience, MH)*

> *“… They have the opportunity to work together and at the same time, get to learn something different from their colleagues. As I said earlier,*

each of the students has been sent to different departments." CS2M4 (1 year of teaching experience, 15 years of industry experience, MH)

"… They can ask their colleagues who is free to come along and join them. At least they can help and learn together." CS2M7 (1 year of teaching experience, 2 years of industry experience, SAH)

WBL students are also expected to participate in group work activities:

"I am concerned with their participation in a group; during discussion, trouble shooting, repairing and other group activities. I will try to identify who is the 'passenger' in that group, who doesn't really do any work." CS2M6 (1 year of teaching experience, 2 years of industry experience, SAH)

CS2M4 likes the way his mentee approaches him in reminding him about the work plan.

"… He will remind me what we have done yesterday and what we should do today. It is a good practice because I sometimes tend to forget. I really appreciate his effort. For me, this is the kind of teamwork that I like." CS2M4 (1 year of teaching experience, 15 years of industry experience, MH)

CS2M6 shares his experiences in developing the WBL students' teamwork skills.

"I give one question or problem to them; then I want to see who will react first, how they distribute the tasks, who is able to instruct others and obey them. … From there you can see, who is a leader, can recognise individual capabilities, and how they solve the problem in a group." CS2M6 (1 year of teaching experience, 2 years of industry experience, SAH)

5.2.4 Mentors' GSA Approaches

This section provides findings on the mentors' approaches in assessing the three generic skills – problem-solving, verbal communication and teamwork. Generally, the findings show that most of the assessments are done based on the mentors' observations of their mentees at the end of the semester. This is called outcome assessment.

"The observation is done throughout the semester but the assessment is only done at the end of the semester." CS2M1 (2 years of teaching experience, 3 years of industry experience, TJH)

"… Because we as a mentor will always be with them, so basically we can observe their weaknesses and strengths directly." CS2M6 (1 year of teaching experience, 2 years of industry experience, SAH)

"The observation is done starting from the first day the students are here until the day when I need to assess them." CS2M5 (4 years of teaching experience, 6 years of industry experience, MH)

Some of the mentors consider feedback from others to support their judgements on the assessment:

"We need to admit that we also have our blind spot, so others' opinions and feedback are important to fill the gap where we can't see things." CS2M6 (1 year of teaching experience, 2 years of industry experience, SAH)

"… Sometimes I refer to other colleagues and staff to get feedback on the students' performance." CS2M2 (1 year of teaching experience, 17 years of industry experience, TJH)

"I do refer to other mentors and staff that have experience working with my mentee. For me, it can be used to justify my assessments on him later on." CS2M7 (1 year of teaching experience, 2 years of industry experience, SAH)

Although outcome assessments have their issues, according to CS2M1, the mentors prefer to conduct these rather than progress assessments, because the latter take a longer time.

"I do not prefer progressive evaluation since we are too busy unless I am a full-time mentor." CS2M1 (2 years of teaching experience, 3 years of industry experience, TJH)

After assessment, some of the mentors report that they provide reflections on the students' achievements.

"… The mentor can observe and evaluate their performance. What they did wrong, the mentor will usually guide them in a right way so that they can improve." CS2M3 (1 year of teaching experience, 2 years of industry experience, MH)

"Usually I will inform what marks he/she got for this and this. I will also let the mentee know why he/she got high marks or low marks so that the mentee can improve in the future." CS2M4 (1 year of teaching experience, 15 years of industry experience, MH)

According to CS2M3, some of the mentors do not tell the mentees when the assessment will take place and what the assessment criteria are. These mentors share the belief that this approach is fair to the students as well as to the mentors.

"… We as mentors do not explain the criteria of the assessment. …I am not telling them when I am going to assess them." CS2M3 (1 year of teaching experience, 2 years of industry experience, MH)

a. Problem-Solving Skills Assessment

Most of the mentors claim that they assess problem-solving skills based on the process of reaching a solution.

"I observed the processes that have been considered to get to the solution." CS2M1 (2 years of teaching experience, 3 years of industry experience, TJH)

> *"I consider the initiatives that have been taken by the student to solve the problem." CS2M4 (1 year of teaching experience, 15 years of industry experience, MH)*

However, CS2M3 and CS2M5 consider two approaches: the process of getting the solution and whether, in the end, the problem has been solved or not.

> *"I will take into consideration the process of solving the problem and also whether or not they manage to solve the problem." CS2M3 (1 year of teaching experience, 2 years of industry experience, MH)*

> *"I evaluate the way they perform the tasks, the procedures, how they solve and come out with the solution, whether the problem is solved or not." CS2M5 (4 years of teaching experience, 6 years of industry experience, MH)*

The mentors also say that the mentees are expected to convince their mentors about the solutions taken in order to acquire higher marks. CS2M7 and CS2M4 describe this process as reasoning skills and share their experiences:

> *"I expect him to explain and convince me what the problem is, what is the cause, how to manage it and so on, before he can perform any further tasks. If he can do all that, that means he has very good problem-solving skills." CS2M7 (1 year of teaching experience, 2 years of industry experience, SAH)*

> *"In the process of making the decision, he/she needs to ask my permission first before further action can be made, so I give marks based on that." CS2M4 (1 year of teaching experience, 15 years of industry experience, MH)*

Time taken to solve the problem is also another point considered during assessment by most of the mentors.

> *"… Can he/she manage to solve the problem within the time allocated or not." CS2M4 (1 year of teaching experience, 15 years of industry experience, MH)*

> *"I count how many ways they have considered and the duration taken to find the solutions before giving them marks." CS2M6 (1 year of teaching experience, 2 years of industry experience, SAH)*

> *"For me, yes I have considered time usage during the assessment, because I can use it as a benchmark. If he has frequently solved the problem, it should take less time in the future." CS2M7 (1 year of teaching experience, 2 years of industry experience, SAH)*

However, CS2M5 has a different opinion regarding time usage:

> *"Time is too subjective; we can't really predict how long it will take us to solve the problem. I have experience of trying to repair a machine all day long until the next day." CS2M5 (4 years of teaching experience, 6 years of industry experience)*

The amount of help that the mentee receives from the mentor and other personnel is also considered by the mentor when assessing problem-solving skills.

> *"I also observe if they need to ask further questions or if they can just do it without asking me." CS2M2 (1 year of teaching experience, 17 years of industry experience, TJH)*

> *"… Do they require me to come to the site and help them?" CS2M5 (4 years of teaching experience, 6 years of industry experience, MH)*

b. Verbal Communication Skills Assessment

Verbal communication skills are reported to be assessed mostly during the presentations (daily, TAR and EI).

> *"We also practise giving the students tasks to select a piece of equipment each day and they need to present to us during the small discussions in the morning. … So I gave them marks based on the presentation." CS2M1 (2 years of teaching experience, 3 years of industry experience, TJH)*

> *"First, we will look into the students' confidence levels during the presentation. We notice how they interact, what words they use, if the contents on the slides are appropriate or not…" CS2M3 (1 year of teaching experience, 2 years of industry experience, MH)*

Most of the mentors claim that verbal communication skills assessments are based on how well students manage to answer questions and are able to communicate with surrounding people.

> *"Usually the assessments are based on the ability to communicate with the users and not with vendors. Observations are done by the mentor, when they communicate with each other, how they raise and answer questions, their understanding of the discussion topic…" CS2M2 (1 year of teaching experience, 17 years of industry experience, TJH)*

> *"We also assess on the way they answer the question, contents of the presentation and how they manage to explain about discussion topic." CS2M3 (1 year of teaching experience, 2 years of industry experience, MH)*

> *"… When the student communicates or interact with the users… answering questions from others and so on. Not only users, but also when they interact with other mentors, colleagues and me as well." CS2M4 (1 year of teaching experience, 15 years of industry experience, MH)*

CS2M5 suggests that assessments of verbal communication skills should not be conducted on a daily basis, as the students' skills need time to improve:

> *"For me, I do not evaluate the students every day. Usually I do it on a weekly basis, when you start to see significant improvement. It takes time for someone to improve; it does not happen in a short time."*

CS2M5 (4 years of teaching experience, 6 years of industry experience, MH)

According to CS2M6, the evaluation of verbal communication skills directly reflects the users' satisfaction.

"I will ask the users whether they are satisfied with the way my mentee is dealing with them or not." CS2M6 (1 year of teaching experience, 2 years of industry experience, SAH)

Likewise, CS2M4 emphasises that the assessment must be subject to the students' ability to follow the mentor's guidance when communicating with users:

"One thing regarding the verbal communication assessment is that, if I have guided them earlier and they didn't follow, it will affect their marks badly." CS2M4 (1 year of teaching experience, 15 years of industry experience, MH)

c. Teamwork Skills Assessment

Most of the mentors claim that teamwork is assessed individually:

"Normally the marks are given individually, although the task was done through group work." CS2M1 (2 years of teaching experience, 3 years of industry experience, TJH)

"Basically the objective of the assessment is to see the individual effort towards working in a group." CS2M3 (1 year of teaching experience, 2 years of industry experience, MH)

Willingness to help others is commonly reported among the answers when assessing teamwork skills.

"… Their willingness to help other students or staff when needed." CS2M2 (1 year of teaching experience, 17 years of industry experience, TJH)

"I will observe their willingness to help others as well, their own initiative without me asking them to do so." CS2M3 (1 year of teaching experience, 2 years of industry experience, MH)

"I will observe their willingness to help others. Is this their own initiative, or do they need someone to instruct them to help?" CS2M6 (1 year of teaching experience, 2 years of industry experience, SAH)

In addition to their willingness, CS2M3 also observes whether or not team members are able to work together:

"I will look at whether he/she can easily get along with the others or not." CS2M3 (1 year of teaching experience, 2 years of industry experience, MH)

Some of the mentors particularly observe how well the students are able to listen and follow the instructions given to them.

> *"… How well they listen to and obey my instructions." CS2M4 (1 year of teaching experience, 15 years of industry experience, MH)*

> *"… Who is able to instruct others and obey others." CS2M6 (1 year of teaching experience, 2 years of industry experience, SAH)*

Similarly, CS2M5 and CS2M6 are concerned with mentor-mentee co-operation and how they share ideas.

> *"… How they help me with my work, how they contribute ideas; I will assess from there because the co-operation between them and me is also teamwork." CS2M5 (4 years of teaching experience, 6 years of industry experience, MH)*

> *"… The way they share their ideas." CS2M6 (1 year of teaching experience, 2 years of industry experience, SAH)*

> *"… I just assess my mentee on how he manages to co-operate with me as his mentor." CS2M7 (1 year of teaching experience, 2 years of industry experience, SAH)*

Another assessment criterion reported by the mentors is looking at a team member's active participation:

> *"Based on our observation, we can see who is a more reliable team member during group work and from there we can give him/her marks." CS2M1 (2 years of teaching experience, 3 years of industry experience, TJH)*

> *"I am concerned with their participation in a group." CS2M6 (1 year of teaching experience, 2 years of industry experience, SAH)*

5.2.5 Mentors' Challenges in GSA

This section presents the challenges that mentors face in generic skills assessment within the WBL environment. For example, CS2M2 and CS2M3 are concerned with the outcome assessment approach, as it requires mentors to have a strong memory recall as to what ha previously happened.

> *"… We need to refresh our minds and remember how the students have performed; basically it is based on the mentor's observation throughout the duration. It's quite hard." CS2M2 (1 year of teaching experience, 17 years of industry experience, TJH)*

> *"Currently it tests the mentor's ability to remember the students' performance from the beginning of the semester." CS2M3 (1 year of teaching experience, 2 years of industry experience, MH)*

To overcome the above issue, CS2M3 suggests that the institute and WBL coordinator should think of a mechanism for the mentor to record their observations of the students progressively.

> *"I would prefer the institute to prepare guidelines on the mentors' observation in a progressive way so that we could monitor the development of the students and also help us remind ourselves what has been going on previously." CS2M3 (1 year of teaching experience, 2 years of industry experience, MH)*

CS2M2, for example, admit honestly that he just follows whatever arrangements the institute gives in assessing generic skills:

> *"I just accept the instructions and I just assess their soft skills using the provided assessment form." CS2M2 (1 year of teaching experience, 17 years of industry experience, TJH)*

Most of the mentors claim that they lack assessment training. Therefore, they suggest that the coordinator should provide more training on generic skills assessment in the future, so that they have a better understanding when conducting assessments. Although assessment rubrics are provided by the institute, CS2M3 is convinced that more assessment training would promote a better understanding of the assessment processes.

> *"The form has its own criteria and, besides that, each of the criterion has a number from 1 to 5." CS2M5 (4 years of teaching experience, 6 years of industry experience, MH)*

CS2M6 and CS2M4 describe that the criteria written in the rubric assessment are too general:

> *"… For example, only communication skills were included, so it too general. There are no other sub-elements." CS2M6 (1 year of teaching experience, 2 years of industry experience, SAH)*

> *"Like I have mentioned before on the assessment criteria of the soft skills, currently it is just too general." CS2M4 (1 year of teaching experience, 15 years of industry experience, MH)*

Besides, none of the mentors seem to remember or can describe the generic skills assessment criteria stated in the rubrics. There are evidences that the mentors feel external pressures in giving marks. CS2M2 and CS2M4, for example, share their thoughts in this matter:

> *"Frankly, when we give marks either for technical or soft skills, it is more about sympathy and a sign of tolerance from the mentor. This is a confusing matter for us because the results affect the company and the institute's achievement." CS2M2 (1 year of teaching experience, 17 years of industry experience, TJH)*

> *"Just imagine if you failed the students, how will your boss react? For sure it will be bad. Everyone is trying to keep their jobs and trying to look good in their employer's eyes." CS2M4 (1 year of teaching experience, 15 years of industry experience, MH)*

Owing to the heavy workload, CS2M3 suggests that the specialist should help assess the students' problem-solving skills during theoretical classes.

"If I wanted to improve the soft skills assessment then maybe I should include the assessments during the theoretical classes. For example, after the specialist has conducted the theory class, he could also assess the students' soft skills, whether or not they apply what has been taught before in the sense of problem-solving." CS2M3 (1 year of teaching experience, 2 years of industry experience, MH)

5.2.6 Summary of the Mentors' Perceptions of GSA within the WBL Environment

Table 5-2 presents the mentors' teaching practices with the WBL environment (refer to Chapter 5.2.2).

Table 5-2 Summary of the mentors' teaching practices within the WBL environment (Source: author)

<table>
<tr><th colspan="2">Description</th><th>Mentors' Teaching Practice</th></tr>
<tr><td rowspan="6">AL Awareness</td><td>Approach</td><td>WBL</td></tr>
<tr><td>AL Implemented</td><td>2010</td></tr>
<tr><td>Training</td><td>Yes (3 days)</td></tr>
<tr><td>Understanding</td><td>Not clear</td></tr>
<tr><td>Written Guidelines</td><td>Yes</td></tr>
<tr><td>Institution Supervision</td><td>Yes, together with WBL coordinator</td></tr>
<tr><td rowspan="5">Students' Learning</td><td>Learning Motivation</td><td>Performing work</td></tr>
<tr><td>Venue</td><td>Hospital</td></tr>
<tr><td>Time</td><td>During D&O, PPM and RCM</td></tr>
<tr><td>Challenges</td><td>Take time to adapt to the environment, not allowed to work alone on site.</td></tr>
<tr><td>Advantages</td><td>Offer more opportunity to learn, improve knowledge and skills, authentic experience, active students, reduce mentors' workload.</td></tr>
</table>

Through the mentors' interviews, it is clear that there are a lot of learning activities provided to the students. Table 5-3 summarises the activities involved during the development process (refer to Chapter 5.2.3).

Table 5-3 Generic skills development by WBL mentors (Source: author)

Generic Skills	Generic Skills Development
Problem-Solving	Identifying the problem, solving the problem within time and budget, independent, convincing people, being resourceful, preparing possible solutions and logbook writing.
Verbal Communication	Interacting with people, handling situations, explaining in fluent English, conducting presentations, identifying user backgrounds, negotiating, maintaining good relationships and listening, as well as acknowledging, the users.

Teamwork	Co-operating, delegating tasks, giving and following instructions, supportive towards each other, sharing knowledge and ideas, updating individual progress.

Table 5-4 presents the summary of generic skills assessment tasks as reported by the mentors during the semi-structured interviews (refer to Chapter 5.2.4).

Table 5-4 Generic skills assessment tasks (Source: author)

Generic Skills	Assessment Tasks
Problem-solving	Discussion, project and logbook writing
Verbal Communication	Presentations (daily, TAR and EI), discussion and Q & A
Teamwork	Group's project and discussion

The description of the generic skills criteria for the assessment reported by the mentors can be summarised as shown in Table 5-5 (refer to Chapter 5.2.4).

Table 5-5 Summary of mentors' description of generic skills assessment (Source: author)

Generic Skills	Assessment Descriptions
Problem-solving	Identifying the problem, preparing contingency solutions, convincing, verifying decisions with superior, independent, solving problems within time, users' feedback and satisfaction.
Verbal Communication	How well students manage to answer questions, establishing verbal communication with the surrounding people, based on users' feedback, following mentor guidance, conversing in English.
Teamwork	Individual marks, sharing ideas, giving and following instructions, aware of own roles, delegating tasks, co-operating and supporting.

Table 5-6 outlines the mentors' challenges during assessing students' generic skills (refer to Chapter 5.2.5).

Table 5-6 Mentors' generic skills assessment challenges (Source: author)

Challenges	Description
Training	Not provided
Limited time	Yes
Assessment Scheme	Provided but too general (Rubric)
Assessment Method	Mentor's observations
Industry Feedback	Yes

One of the WBL mentor's transcripts is presented in **Appendix 6A**.

5.3 Findings of Students' Perceptions of GSA within WBL Environment

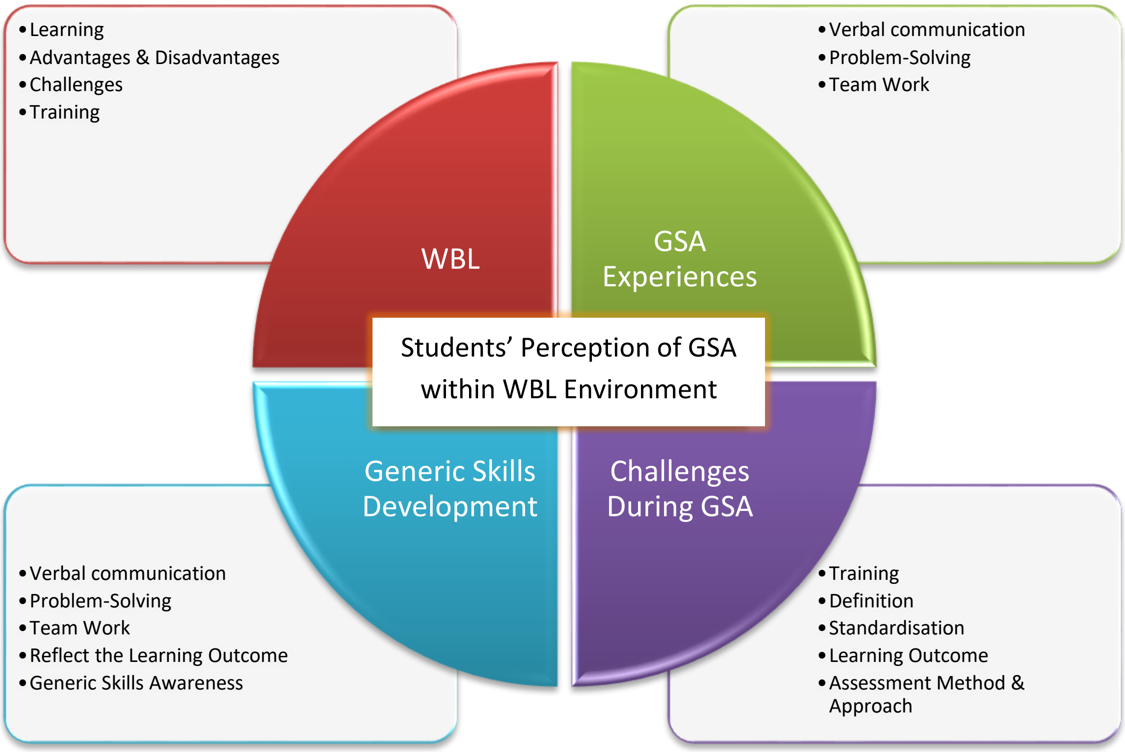

Figure 5-8 Students' perceptions of GSA within a WBL environment main themes (Source: author)

Eight final year Bio-Medical Electronics Engineering are selected in this case study by the WBL coordinator. This was with the approval of the concession company that had been given full responsibility by the Ministry of Education Malaysia to conduct the WBL research in the hospitals' premises. The students involved in this research are near to graduation and are exposed to the generic skills assessments. Similar characteristics to Case Study 1 have been considered, including their age, gender, ethnicity and previous educational background. An additional criterion of geographical location has also been considered. These criteria are important to ensure there is a range of students to give a broad perspective on the generic skills assessment processes and the standardisation of this practice amongst the locations.

Using the same reasoning as in Case Study 1, the researcher conducts semi-structured interviews to gain a better understanding of the generic skills assessment process from the students' perspective. The questions covered in this research consist of their experience during the WBL process, advantages and disadvantages of the approach, and challenges in implementing it. The researcher further investigates the students' perceptions of generic skills assessment within the WBL environment: how the skills are being developed and assessed, and what the potential challenges are during the assessment process. The analyses from the

WBL students' transcripts show that there are four main themes that emerge from the interviews as displayed in Figure 5-8: WBL, generic skills development, its assessments and challenges. Accordingly, these findings and analyses are believed to have answered a part of the research question: "What are the students' experiences of generic skills assessment?''

5.3.1 Students' Background

The students' brief biographies are shown in Table 5-7. A set of names are created for the students, who are then only recognised by the researcher and his supervisor. Information on the respondents' profiles are further presented in Figure 5-9, Figure 5-10, Figure 5-11 and Figure 5-12.

Table 5-7 Students' biographical background (Source: author)

Participant	Biographical Background
Case Study 2	
CS2S1	A 24-year-old male. He holds a Certificate in Electrical and Electronic Engineering, and a Diploma in Bio-Medical Electronics Engineering. He is currently in TJH.
CS2S2	He is a 25-year-old student. He has a year of working experience as a technician and holds a Diploma in Computer Electronics before furthering his studies in this institute. He is a colleague of CS2S1 in TJH.
CS2S3	He is a 24-year-old male. He has experience working as a government support servant for 1 year. He completed his Diploma in Electronics Engineering in 2012. He is in MH.
CS2S4	A 23-year-old male. He holds a Diploma in Computer Electronics from one of the polytechnics in Malaysia. He was placed in MH.
CS2S5	A 23-year-old male. He holds a Diploma in Electronics Engineering. Currently he attends WBL in SAH.
CS2S6	He is a 24-year-old male. He has a Diploma in Electronics Engineering. He is a colleague of CS2S5 in SAH.
CS2S7	A 24-year-old female student. She holds a Diploma in Bio-Medical Electronics Engineering. She is in SIH.
CS2S8	She is a 24-year-old female. She holds a Diploma in Electronics Engineering from one of the polytechnics in Malaysia. She is a colleague of CS2S7 in SIH.

Note: The year in which the data is collected is 2014

This section provides basic information on the students which includes gender, age, ethnicity, the students' academic background as well as their geographical location. This data might be useful in providing additional information as to how the students' experiences might be affected regarding the development of their generic skills and their reflections of assessment processes.

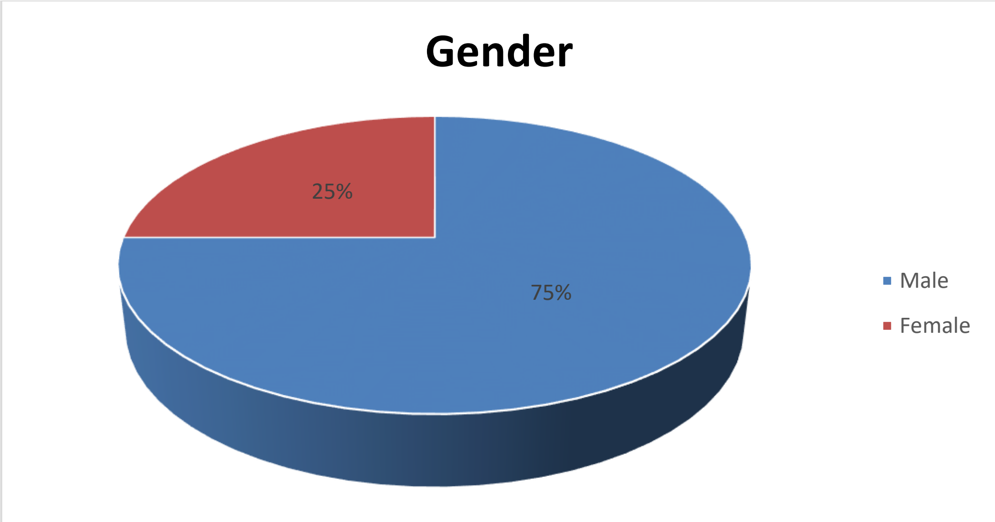

Figure 5-9 Distribution of students' gender (Source: author)

Figure 5-9 presents the distribution of gender for the WBL students. Six out of the eight students are male (75%), while the remaining two are female.

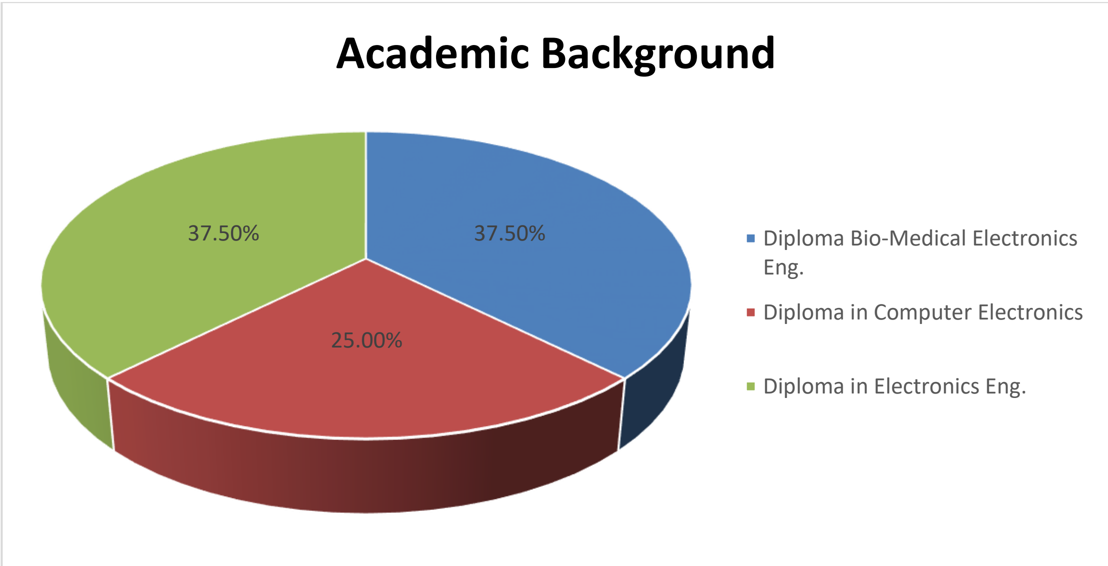

Figure 5-10 Distribution of the students' academic background (Source: author)

All of the students hold a diploma qualification in several disciplines as it is the criterion that is required before furthering their study. Three of the students (37.5%) are diploma graduates from Bio-Medical Electronics Engineering and Electronics Engineering while the other two (25%) are Computer Electronics graduates.

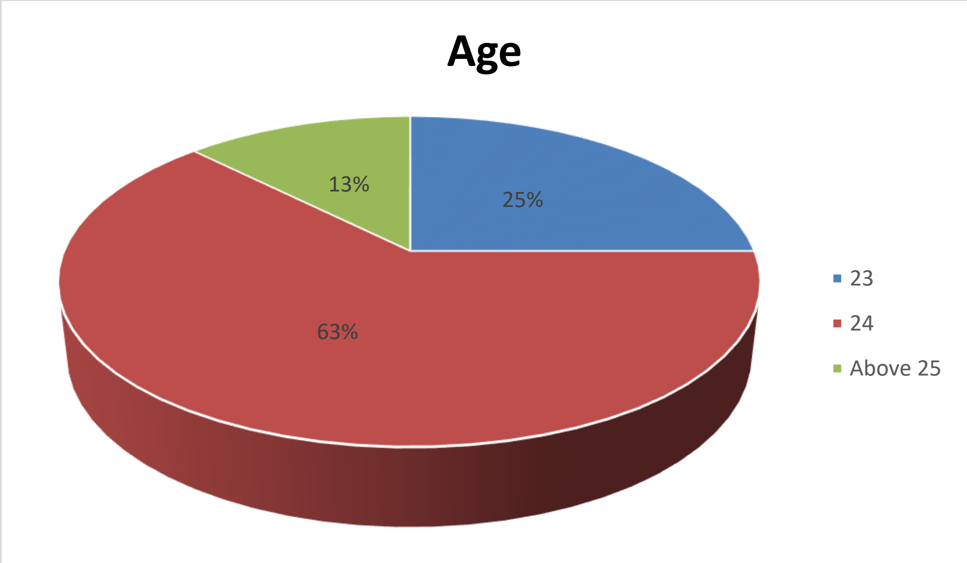

Figure 5-11 Distribution of the students' age group (Source: author)

The majority of the students (62%) who participated in the semi-structured interviews are 24 years old. This group of students are reported to have at least one to two years of working experience before studying in this institute. CS2S2 is the only student aged above 25 years old in this case study.

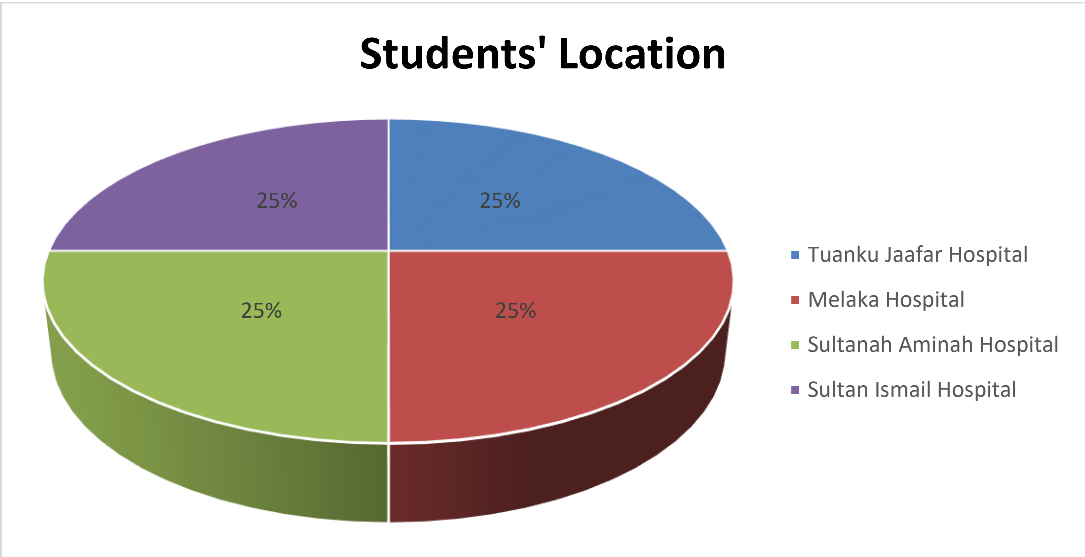

Figure 5-12 Students' location (Source: author)

Eight students are interviewed at four different hospitals located in three Southern States of Malaysia. Two students (25%) are placed in each of the locations as shown in Figure-5-12. Two hospitals are located in Johor (SAH and SIH), one in Melaka (MH) and the other in Negeri Sembilan (TJH).

5.3.2 Students' Learning within WBL

All of the WBL students have the same understanding on the WBL approach.

> *"The nature of learning is where we learn through experience especially when performing the work…" CS2S4 (23, MH)*
>
> *"We learn from what we do during the work." CS2S3 (24, MH)*
>
> *"…Learning sessions in industry or in the working environment." CS2S5 (23, SAH)*
>
> *"WBL is the approach where we learn while we work." CS2S6 (24, SAH)*

CS2S8 differentiated the students' placement in a WBL environment.

> *"Previously during the diploma placement, I tend to listen more rather than working but now, in WBL, I work more and listen less." CS2S6 (24, SAH)*

Through the students' semi-structured interview findings, it can be seen by the researcher that none of the students have experienced WBL before entering this institute. For that reason, most of the students admit that they required some time to adapt with the new environment and the surrounding people.

> *"… It takes time for me to adapt to the new environment and people." CS2S2 (25, TJH)*
>
> *"I think during the first week of WBL, I had problems familiarising with the environment." CS2S3 (24, MH)*

The students report that it was compulsory for them to attend two weeks of WBL training, which was conducted by company personnel as well as lecturers from the institute. CS2S1 and CS2S3 explain briefly the contents of the training.

> *"… It is something like a revision class on how to handle the equipment, what we should do and what we can't do during the WBL." CS2S1 (24, TJH)*
>
> *"They explain the company's (industry) background, what they expect the students to do in the industry, introductions to several pieces of equipment that will be commonly used and so on." CS2S3 (24, MH)*

In addition to the training, students are also equipped with a manual book of WBL.

> *"… There is a manual book regarding WBL. It explains the syllabuses that will be covered and so on." CS2S2 (25, TJH)*

The students' learning processes are held over one year in the hospital environment and they have to complete several modules which are related to Bio-Medical equipment that have been prepared by the institute and the concession company.

> *"All WBL students need to complete the subjects/modules during WBL. The subjects are all about the Bio-Medical electronics equipment that is available in the hospital." CS2S4 (23, MH)*

> *"The time taken to complete the WBL is about 1 year, so I believe I can experience and have more opportunity to learn other Bio-Medical equipment." CS2S7 (24, SIH)*

Learning and working within the hospital environment requires the students to be mentally prepared and aware of safety at all times because they might come in to contact with blood or corpses. Furthermore, the environment and surroundings of the students made them prone to a wide range of sicknesses and diseases if they do not take safety seriously.

> *"I do feel a bit nervous; you know that you are working in a hospital with blood everywhere, sick patients and dead bodies around." CS2S2 (25, TJH)*

When working at the site, according to CS2S6, it is the hospital's policy to make sure that the students are accompanied by their mentors at all times.

> *"WBL students are not allowed to troubleshoot, repair or even come to the site alone. We must be accompanied by our mentors all the time when we are at the site." CS2S6 (24, SAH)*

The learning process in WBL starts with the mentors' guidance in performing work on site.

> *"At first, the mentor performs the job. He explains the processes, procedures and so on. If we face the same problem 2-3 times, we already know the cause of the problem and how to solve it." CS2S3 (24, MH)*

> *"… Need to follow your mentor and have general ideas on how to solve it, and once you feel confident, the mentor allows you to perform it by yourself." CS2S4 (23, MH)*

According to CS2S7, it took quite some time to acquire her mentor's trust.

> *"I think it took about 1-2 months for him to feel confident in what I am doing because during that period he observes me and sees whether or not I can communicate well with the user, whether or not, I have gained the knowledge about the equipment and know how to repair it." CS2S7 (24, SIH)*

One of the benefits of WBL that was reported by the students is that, they are offered an authentic opportunity (the hospital environment) to apply what they have previously learnt according to industry standards.

> *"An opportunity to recognise and learn about new equipment that is not present in polytechnic institutions, that is used in industry. We also learn how to solve problems using industry standards." CS2S1 (24, TJH)*

> *"In WBL, the job requires us to handle industry equipment personally, one to one; it is an advantage for me." CS2S3 (24, Malay, MH)*

> *"I learn how to trouble shoot and repair by myself and get the chance to have real working experience in a working environment." CS2S8 (24, SIH)*

Similarly, WBL helps to build up the students' confidence when communicating with the users as well as during the problem-solving activities.

> *"I feel more confident to talk with the users, not only staff nurses and sisters, sometimes even doctors as well… It helps me to develop my trouble shooting skills." CS2S3 (24, MH)*

> *"I am also learning the way my mentor communicates with the users, repairing procedures and so on." CS2S7 (24, SIH)*

The WBL environment is reported to have motivated the students' learning:

> *"One year in WBL gives me the opportunity to gain more experience; furthermore, I am in Bio-Medical Electronics and this requires me to be fully knowledgeable and focused; I need to know the methods to repair the equipment that are available in the industry, so there are a lot of things that I need to know and be familiar with." CS2S1 (24, TJH)*

CS2S8, for example, describes that she could apply her previous knowledge during WBL:

> *"… Probably this is the time where I can apply what I have learnt during when I was a polytechnic student." CS2S8 (24, SIH)*

The students are also aware that WBL requires their commitment towards independent learning:

> *"The advantages include that we get to understand the things that we learn, so we learn independently." CS2S4 (23, MH)*

> *"That is why for me, I need to be more active in asking questions because I am the one who has to learn." CS2S8 (24, SIH)*

Another advantage of WBL, is that if the students perform well during WBL, it will increase their work opportunities as they may well be offered a position in the company.

> *"… Most of the WBL students, after they have completed the WBL, their superiors often offer them a place to work in their company." CS2S2 (25, TJH)*

> *"… Her mentor has been transferred to another hospital, so she replaces her as she already knows all about her mentor's responsibilities." CS2S7 (24, SIH)*

Mentors in WBL are responsible for guiding and teaching the students:

> *"If the way we perform the tasks is wrong, then they will advise and guide us. That is the good thing about WBL." CS2S4 (23, MH)*

> *"I realise that all the mentors are willing to teach and co-operate with us." CS2S1 (24, TJH)*

However, there is also evidence that some of the mentors have difficulties in sharing their knowledge with the students:

> *"… There are a few of the mentors who are not willing to teach and co-operate with the students. It is common." CS2S2 (25, TJH)*

Despite all the advantages, WBL also has its challenges. It is reported that some of the students are hired as contract staff during the WBL programme. This has resulted in the steady decrease of the students' opportunities to learn other Bio-Medical equipment.

> *"… Once you have been selected as a contract staff, for example CS2S3, he is in charge of the HDU (Haemodialysis Unit). He will be the one who is responsible to take care of the unit. So, the chances for him to learn other equipment are limited." CS2S4 (23, MH)*

Similarly, the mentor is responsible to maintain all equipment and making sure that the right equipment is in the right department. According to CS2S7, there are five main departments in the hospital; the General department, the Lab department, the Critical Care unit, Dialysis department and Analysis department. As a mentee, it is their responsibility to follow their dedicated mentors. Some of the students report that the policy decreases their chances to learn other equipment in other departments.

> *"The problem that I face is that my mentor is a specialist in dialysis. So, I am always spending my time with my mentor in the Dialysis department and this gives me little chance to learn about different equipment from different departments." CS2S5 (23, SAH)*

For that reason, CS2S5 suggests that perhaps the WBL coordinator could rotate the position of the mentors among the students to increase the students' knowledge and give them a chance to explore other Bio-Medical equipment in the future.

5.3.3 Generic Skills Development

This section presents the findings of the students' experience in developing generic skills, namely: problem-solving, verbal communication and teamwork within the WBL environment. It is important for the researcher to identify the activities involved, how skills have been developed and, later, to verify whether or not the activities conducted are considered during generic skills assessment.

The students show their awareness of the importance of acquiring generic skills during WBL and for the future:

"I admit that communication skills such as presentation skills are very important, not only during my polytechnic studies but also after I have an established career." CS2S1 (24, TJH)

"For me, working in a team is better than working alone." CS2S3 (24, MH)

"Communication is very important to establish good relationships, especially with the users." CS2S6 (24, SAH)

In WBL, generic skills are mostly developed during the process of RCM, PPM and Demonstration and Observation (D&O). CS2S8 and CS2S6 briefly explain the processes involved.

"It is during the Demonstration and Observation session. Usually for that session, the specialist for a particular piece of equipment will teach WBL students about the equipment, for example the physiotherapy machine. He will explain to us from A to Z, how to repair it, how it functions and so on." CS2S8 (24, SIH)

"Repairs and Corrective Maintenance (RCM) is where we are responsible for fixing the broken machine. While PPM – Planned Preventive Maintenance, where we need to perform maintenance as scheduled." CS2S6 (24, SAH)

a. Problem-Solving Skills Development

The students report that they are trained to understand the problem as a whole before trying to solve it, especially during the trouble shooting process.

"… We need to know the flow from where the supply starts until where it goes to on the equipment." CS2S1 (24, TJH)

"… We need to identify where the fault comes from." CS2S2 (25, TJH)

"I will identify and find the cause of the problem..." CS2S7 (24, SIH)

Students are also expected to record their progress and work procedures in a logbook on a daily basis for future reference and assessment.

"Listing down all the procedures that were taken when performing the task for my future reference. It can also be used as a manual book for me." CS2S4 (23, MH)

"… If I dismantle the dialysis machine, I need to list down the procedures in the logbook, sometimes draw the actual parts in detail." CS2S5 (23, SAH)

"I am not only writing the report: I even snap photos to support my explanations as well." CS2S8 (24, SIH)

In solving complex problems, sometimes students are required to ask questions and receive help from others who are more knowledgeable and experienced:

"… If we cannot solve very complex problems, we will ask the vendor to come and solve it for us…. At the same time, I can learn new things." CS2S1 (24, TJH)

"If we cannot solve the problem, we will call the AP specialist and other seniors to help us. If we still cannot solve it, then we will call the vendor to step in." CS2S3 (24, MH)

However, CS2S7 has different thoughts on the above matter. She tried not to depend too much on others so she could win her mentor's trust.

"… If I can manage to repair the machine without asking for help, it is better. It will give an indication to the mentor that I can work independently and that he can count on me to solve future problems relating to the equipment." CS2S7 (24, SIH)

Besides asking help from others, finding information from multiple resources such as books, manuals and the Internet are common answers reported by the students to the question of how they go about problem-solving.

"… Find information from the books in the library and the Internet." CS2S2 (25, Malay, TJH)

"Not only the manual booklet, I also refer to the Internet as well because sometimes the manual is not available in the office, so I have to download it from the Internet." CS2S3 (24, MH)

CS2S7 personally appreciates her skills of finding information which she has developed during WBL.

"From there we can learn the hard part to gain the information and we tend to appreciate it more." CS2S7 (24, SIH)

It is also reported by the students that they are encouraged to think critically on possible solutions when solving problems given by the mentors.

"… The mentor always asks me if the problem is like this, then what will I do." CS2S1 (24, TJH)

"… Think critically to find possible solutions, maybe 2 or 3 possible solutions." CS2S7 (24, SIH)

In addition, according to CS2S3, when the workload for his mentor increases, his mentor requires him to work independently at the site:

"Sometimes when that happens I will be separated from my mentor. He handles one piece of equipment, and I handle another." CS2S3 (24, MH)

b. Verbal Communication Skills Development

Most of the students admit that the nature of learning in WBL requires them to frequently establish verbal communication with the users. These relationships are critically important to ensure that everything runs smoothly in the future.

> *"If we can establish good communication and have a good relationship with the user, things will run smoothly for both parties." CS2S1 (24, TJH)*

> *"I have established a good relationship with them because we respect each other. I do not have any problems when I communicate and work with anyone." CS2S6 (24, SAH)*

CS2S3 describes concisely the users who are involved during WBL:

> *"Users are doctors, staff nurses and sisters. Usually, these are the staff that are using the equipment. If the equipment is faulty, they are the ones who will issue the complaint." CS2S3 (24, MH)*

Presentations are also common activities that are conducted to develop the students' verbal communication skills. Formal presentations are reported to be held at end of the third and fourth semesters.

> *"In WBL, we need to conduct presentations at the end of the third and fourth semester." CS2S2 (25, TJH)*

CS2S2 and CS2S3 explain the expectations for the presentations at the end of the semesters:

> *"For semester 3, I need to present about the equipment: what is the name of the equipment, how it functions and so on. In semester 4, the presentation is called Engineering Improvement. Basically it is about the improvement of the equipment." CS2S2 (25, TJH)*

> *"At the end of semester 3, we need to choose one piece of equipment with a different brand/model and present the advantages and disadvantages for each model. … In this semester, which is the last semester, the presentation is called Engineering Improvement where we are required to improve current equipment for better use in the future." CS2S3 (24, MH)*

To build up confidence before conducting the actual presentations, mock presentations are reported to have helped the students to overcome their nervousness.

> *"Of course I have performed several mock presentations before the actual one; at least two mock presentations with my colleagues." CS2S4 (23, MH)*

> *"… Before the actual presentation, WBL coordinator has scheduled for my colleagues and I to conduct a mock presentation at our*

headquarters in Melaka. Luckily the presentation went well because I was well prepared." CS2S6 (24, SAH)

Besides formal presentations, there are also informal presentations that are conducted to update the students' progress on a daily or weekly basis based on what has been practiced at the respective hospital. Only CS2S3 and CS2S4 have to present every Friday, while others have to present every day. At the end of both the formal and informal presentations, all of the students are expected to answer questions from the examiner, mentors and other staff members.

> *"They will listen to our presentation and test our knowledge." CS2S7 (24, SIH)*

All of the students agree that it is important to be well prepared and have an in-depth knowledge of the presentation topics to increase their confidence. CS2S4 and CS2S6, for example, describe why this is important:

> *"… If on the day of the presentation, we are required to swap topics, then I will be in a mess, as I am not well prepared and have no or less knowledge on the topic. I can present by means of just reading the slides as I don't have enough knowledge to explain or elaborate on it more." CS2S4 (23, MH)*

> *"For me, if I understand the topic of the presentation and I have the knowledge, I will feel confident to present." CS2S6 (24, SAH)*

According to CS2S1, the presentations can also be conducted via dual language. However, conversing in English is always the preferred language during presentations.

> *"They allow us to use mixed languages. However, they always encourage us to speak in English... What happens in class or in the WBL environment is that, we tend to speak using Malay language" CS2S1 (24, TJH)*

> *"Usually we speak using the Malay language. We are required to speak using English only during presentations." CS2S4 (23, MH)*

Some of the students realise their own weaknesses and take initiatives to further improve themselves:

> *"I know that my English was not so good, so I buy some English books to read, prepare the slides, read and reread again, conduct mock presentations and so on." CS2S1 (24, TJH)*

> *"I need to show my confidence when communicating with others." CS2S6 (24, SAH)*

CS2S8 shares her experience of building her confidence when communicating with the users:

> *"Talking about verbal communications skills, at first I felt so nervous to begin to communicate with the users. But after experiencing it a few times I feel more confident and comfortable." CS2S8 (24, SIH)*

Discussions among the students and staff members are also established via communication technology:

> *"I need to discuss with the seniors or specialist. Sometimes this requires me to do the repairing job by phone. They guide me through the phone." CS2S3 (24, MH)*
>
> *"We usually communicate with the mentor and colleagues using WhatsApp and WeChat." CS2S8 (24, SIH)*

Occasionally, mentors required the students to update the status of their tasks verbally especially when they have work independently without their mentor's around.

> *"Sometimes if the fault is minor, my mentor asks me to go alone and try to solve it. After finishing everything, I need to let him know what I have done." CS2S8 (24, SIH)*

Regardless of all the activities reported by the students, some have experienced difficult situations when developing verbal communication skills. For example, CS2S2 and CS2S6 share their experiences:

> *"I feel scared when I need to communicate with the users because the users here are sensitive and are perfectionists. If they are not satisfied with our work, they will let us know immediately." CS2S2 (25, TJH)*
>
> *"It is challenging when the user reacts aggressively, asking when we can repair the machine and so on, so we need to be able to explain to them nicely…" CS2S6 (24, SAH)*

The time constraint is CS2S3's difficulty when preparing the material for slides:

> *"… Sometimes the time constraint drags me down because I have so much work that I need to settle. I need to prepare the slides and everything." CS2S3 (24, MH)*

c. Teamwork Skills Development

It is reported that the students are given flexibility in choosing their team members for group work.

> *"… We can choose our group members for ourselves because we know who we can work with." CS2S3 (24, MH)*

However, occasionally, the mentors are involved in dividing the students into groups. The level of knowledge and skills that the students have acquired are among the criteria that are considered during the process.

> *"… The mentor will divide us according to our knowledge and skills." CS2S1 (24, TJH)*

Individual tasks are given accordingly with respect to individual strengths:

> *"… One of them is in charge of the programming, while another is responsible for finding the information through the Internet, and another does the typing. Everyone will have their own tasks." CS2S3 (24, MH)*

CS2S5 shares his thoughts on this matter, whereby he believes that it is important for students to be aware of each team member's capability as an individual when working in a group.

> *"… Identify the team member's capability so that we can rely on them if we need help that is related to their area of expertise." CS2S5 (23, SAH)*

The mentors' co-operation with the students is reported as another activity that is involved in developing teamwork skills.

> *"I can see that all of the mentors are willing to teach and co-operate with us." CS2S1 (24, TJH)*

In addition to working with their dedicated mentor, students are expected to work together with other people as well:

> *"Instead of just working with my dedicated mentor, I have worked with other mentors, colleagues and vendors as well." CS2S2 (25, TJH)*

> *"… I work and communicate with the vendors too." CS2S5 (23, SAH)*

Helping other colleagues in completing their tasks is also among the practices in developing the teamwork skills.

> *"… Sometimes when there is a colleague who has some free time, he/she will join and help others who still have uncompleted tasks to solve." CS2S7 (24, SIH)*

Another activity used to develop teamwork skills in WBL is group discussions. This involves reviewing the tasks that have been completed, talking about ideas and sharing knowledge among the students.

> *"… Have a discussion with my colleagues. … listen to individual mock presentations and give feedback." CS2S1 (24, TJH)*

> *"Basically we will share our opinions and knowledge…" CS2S2 (25, TJH)*

"If they don't understand, I will teach them and if I don't understand they will teach me. This way we can help each other." CS2S6 (24, SAH)

According to CS2S8, students should listen to and respect ideas from other students when working in a group:

"Each of the group members need to listen to the person who gives an idea. We should respect the opinions of others…" CS2S8 (24, SIH)

Group discussions among the students are reported to have been conducted not only in the respective hospitals but also involving colleagues from other hospitals too.

"We also have group discussions. We have about 20 students who are involved with WBL in different locations. If we have a problem, for example, about a particular piece of equipment, we just post the problem in the WhatsApp group and ask if anyone has encountered the same problem. In a way, we get to help each other even though we are far from each other." CS2S2 (25, TJH)

There are a number of challenges faced by the students when developing teamwork skills. Among the challenges reported by the students are: having no contributions from team members, situations in which it is hard to advise a colleague who has done something wrong, and having a team member who always gives excuses.

"There is a member from my group who does not contribute at all…" CS2S3 (24, MH)

"I will let him know indirectly through sarcasm and such. Hopefully he will realise what I meant." CS2S4 (23, MH)

Some of the students claim that group activities did not happen that frequently:

"Sometimes we need to help other colleagues at the site, but it is quite rare." CS2S4 (23, MH)

"… In WBL we have less group activities." CS2S7 (24, SIH)

"However in WBL, I would say there's less work in groups." CS2S8 (24, SIH)

5.3.4 Students' Experiences during GSA

This section presents the findings f the students' experiences of the assessment approaches of the three generic skills, namely: verbal communication, problem-solving and teamwork. The findings confirm the activities considered during the generic skills assessment by the mentor within the WBL environment.

Generally, generic skills assessments are conducted based on the mentors' observations of the students' performance.

> *"During WBL the mentor will observe how we perform the task…" CS2S1 (24, TJH)*

> *"I am sure that the assessment is based on their observation when we are doing our work." CS2S7 (24, SIH)*

In addition to the mentors' observations, CS2S5 and CS2S7 comment that perhaps the assessments are taken after considering the feedback from staff members and users.

> *"… Maybe before he wants to give us the marks, he will ask someone else such as the user or other staff members about my performance as well." CS2S5 (23, SAH)*

> *"… He might ask the people that I have worked with. Probably that is why I need to inform him if I want to follow other staff members so that during the assessment he knows who he can refer to." CS2S7 (24, SIH)*

The time allocated for conducting assessment has been acknowledged earlier by the institute and the WBL coordinator:

> *"Normally, the assessments will follow the schedule which has been given earlier." CS2S1 (24, TJH)*

It has also been identified that the format of the assessments was in a rubrics form:

> *"It has numbers from 1-5. The mentor will need to circle the number, 1 is very bad, 3 is average and 5 is very good." CS2S2 (25, TJH)*

> *"… It has several criteria and it has a box that is numbered from 1 to 5. 1 is very bad, 3 is average and 5 is very good." CS2S5 (23, SAH)*

The students' reflections, after the generic skills assessment has been conducted, are important in order for them to identify their strengths and weaknesses for self-improvement in the future. CS2S1 describes the importance of this process:

> *"First I will ask myself why the lecturer gives me low marks. I will think that maybe I am weak in this area or maybe I am not good enough. Next, I will ask the mentor or the lecturer how I can improve, because I think if I work hard and improve the marks, people will see my effort and judge me accordingly." CS2S1 (24, TJH)*

However, some of the students do not feel the same way and just accept the marks given by the mentor:

> *"I never ask my mentor about my marks. I trust their judgement on my performance and accept the given marks." CS2S3 (24, MH)*

> *"I don't really care about the marks. I am only concerned about the knowledge and skills that I can gain." CS2S4 (23, MH)*

a. Problem-Solving Skills Assessment

Problem-solving skills are reported by the students to be assessed at the end of the semesters.

> *"… It will be given at the end of the semester." CS2S1 (24, TJH)*
>
> *"… They will assess once at the end of the semester. I am sure of it." CS2S4 (23, MH)*

Most of the students report that the assessment focuses on the process of solving the problem.

> *"The assessment will focus on the processes. How we solve the problem. For example, if the fuse is burnt, they will observe how we trouble shoot, how to verify the cause of the problem, procedures that need to be taken and so on." CS2S1 (24, TJH)*
>
> *"What I realised is that the marks will be given based on the process of finding the solutions, the steps taken into consideration and so on, rather than seeing whether we able to solve it or not." CS2S6 (24, SAH)*

However, CS2S2 and CS2S3 assume that the problem-solving skills assessments are based on whether or not the problem has been solved:

> *"I think the marks will be given on whether or not we can solve the problem." CS2S2 (25, Malay, TJH)*
>
> *"… How I managed to solve the problem, maybe that will contribute to my problem-solving skills marks." CS2S3 (24, MH)*

There is some evidence showing that being able to solve the problem within the given time is a part of the problem-solving skills assessment:

> *"… Whether or not we can solve the problem within the given time. If we solve it using more than the time allocated to us, then maybe we will get low marks and vice versa." CS2S6 (24, SAH)*

Being able to decide on the best solution is reported as another criterion of the assessment:

> *"… Whether we have made the right decision or not…" CS2S1 (24, TJH)*

CS2S3 further describes, for a student to be able to think of possible solutions, that particular student needs to be creative, especially when there are limitations involved when encountering a problem:

> *"It really needs us to think of creative ways of how to solve the problem with the limited parts/tools." CS2S3 (24, MH)*

CS2S3 further describes that his mentor could be assessing his problem-solving skills by observing whether or not he is able to answer questions:

> *"In the sense of problem-solving, I think that if a problem appears, the mentor will ask me what I shall do next. If we can answer all the questions well, maybe he/she will give us the appropriate marks from there." CS2S3 (24, MH)*

Similarly, being able to work independently at the site was another assessment criterion reported by the students:

> *"… less depending on the mentors. Maybe he/she will award extra marks on that." CS2S4 (23, MH)*

Besides the observations from the mentors, it is also reported in the students' interview transcripts that logbooks are also used to assess problem-solving skills as they record every procedure and progress of the tasks performed by the students.

b. Verbal Communication Skills Assessment

Most of the students report that verbal communication skills are mainly assessed based on how well the students interact and communicate with surrounding people.

> *"If I am not mistaken, how we communicate with people, how we interact with the staff is assessed…" CS2S2 (25, TJH)*

> *"Actually I have seen the assessment forms and, as far as I can remember, it evaluates how well we communicate with our mentors." CS2S5 (23, SAH)*

Similarly, being able to elaborate on answers to the questions from multi-level users as well as from the mentor was also another criterion of the assessment:

> *"Sometimes the doctor also asks about the equipment, so we need to know how to answer their questions technically. The same thing happens if we receive questions from the users." CS2S3 (24, MH)*

> *"There will be a lot of questions asked during the presentation, I guess the assessment also evaluates on how well the students can answer those questions and elaborate the data." CS2S4 (23, MH)*

> *"… The way we convey the information to others..." CS2S5 (23, SAH)*

The students' interview transcripts indicate that some of the mentors assess the students' verbal communication skills to see how the students manage to update their work progress when they are asked to perform a job alone or if they get help from other mentors at the site.

> *"… Probably when we report our progress verbally." CS2S2 (25, TJH)*

"After completing my task, I need to let him know what I have done." CS2S8 (24, SIH)

Other verbal communication skills assessment criteria reported by the students are the contents of the presentation and the confidence levels that they show when they are conducting presentations.

"I think during the presentations, the mentor assessed me on the contents of the presentation and my confidence level during presentation." CS2S4 (23, MH)

Users are reported to be under pressure when the equipment breaks down. The students' ability to calm the users and the ability to be able to control different situations are other verbal communication skills assessment criteria.

"When there are many pieces of equipment that are faulty, it makes the users tense and feel pressured. Then, they will pressure us to repair it as soon as possible. This will really test us on how we handle the situation. Of course, we cannot be mad with the users; we must know how to calm them down." CS2S3 (24, MH)

c. Teamwork Skills Assessment

It has been identified through the students' interview transcripts that the teamwork skills assessments are implemented when the students conduct presentations and discussions:

"I think the mentor assesses the skills during the presentations as well." CS2S3 (24, Malay, MH)

"Usually the marks will be given during the discussions and presentations…" CS2S4 (23, MH)

According to CS2S3 and CS2S4, marks are also given if the students manage to divide the tasks fairly among team members when solving problems in a group.

"Usually the mentor will give us big tasks or assignments, and we realise that the task is impossible to be done alone so we need to divide the task in order to solve it in time." CS2S3 (24, MH)

"… How well we manage the group." CS2S4 (23, MH)

When the assignments or tasks are performed in a group, CS2S3 reports that the same marks are given to all of the team members.

"If we come from the same group, we are going to have the same marks." CS2S3 (24, MH)

Some students feel that their willingness to help and support their mentors is also a criterion considered by the mentors when assessing teamwork skills.

"… How we offer help to others while repairing the equipment, maybe…" CS2S2 (25, TJH)

"My mentor and I also consider ourselves as a team, so maybe he will evaluate how much I have contributed to help him during work…" CS2S6 (24, SAH)

5.3.5 Students' Difficulties during GSA

This section provides information on the students' difficulties during the generic skills assessment process. One of the challenges identified from the students' transcripts is the mentors' bias during the generic skills assessment.

"For example, if we don't have a good relationship with our mentors. The mentors will give us poor marks even though we have completed our tasks perfectly." CS2S6 (24, SAH)

"So, to avoid bias in giving marks, I tried to treat my mentor well." CS2S5 (23, SAH)

Another obvious challenge in assessing generic skills is that most of the students consistently complain that they are not aware of the assessment criteria. The students assume that the mentors' approaches towards assessment are similar to the ones described in the previous section. Below are among the answers given by students when the researcher asked about the generic skills assessment criteria:

"Frankly, I don't know the criteria sir." CS2S1 (24, TJH)

"I am not sure about the assessment criteria sir." CS2S2 (25, TJH)

"I don't know how and when they are conducting the assessments." CS2S7 (24, SIH)

"I am not sure when and how my mentor assesses the skills." CS2S8 (24, SIH)

Another common answer from the students when the researcher asked them about the generic skills assessment criteria is that they have not been briefed about said criteria by the mentors or WBL coordinator.

Furthermore, the students claim that the generic skills criteria specified in the assessment forms are too general:

"It is basically about the students' capability; for example, ability to communicate. There are boxes that we need to tick from 1 to 5. The ability to complete group work and so on." CS2S4 (23, MH)

"I think the assessments are too general as it does not specify the assessment criteria." CS2S7 (24, SIH)

The students also realise that there are no reflections or feedback from the mentors after the generic skills assessment has taken place:

> *"Furthermore we don't know what has been assessed, their comments and so on. If I did a mistake, for me, I should be informed about it so that I will not repeat the same mistake again in the future. If I am doing well, then I should keep it up. This matter really makes me feel disappointed." CS2S7 (24, SIH)*
>
> *"I want to suggest that, after the assessments have been taken, the mentor should brief me of the details. What my mistakes are, the things I have done correctly and such, so that I know where to improve and which things to maintain." CS2S8 (24, SIH)*

With regards to the above matter, a few recommendations from the students are identified from the interview transcripts that could provide improvement in the generic skills assessment within the WBL in the future.

> *"I would prefer if the mentor could clarify to me the assessment criteria before the assessments take place for us to know the expectations that they have for us." CS2S1 (24, TJH)*
>
> *"I guess the assessments should explain the criteria of the communication skills, for example: convince the users, how I address the questions to my mentor, ways of communication with the users, and so on." CS2S8 (24, SIH)*

5.3.6 Summary of Students' Perceptions of GSA within the WBL Environment

Students' learning was reported happened during D&O, PPM and RCM. Table 5-8 presents the summary of the students' experience within WBL environment (refer to Chapter 5.3.2).

Table 5-8 Students' learning within WBL (Source: author)

Description	Students' Learning
AL Experience Previously	None
AL Training	Provided – 1 week
Written Guidelines	Yes
Venue	Hospital (4 locations)
Time	During D&O, PPM and RCM
Challenges	WBL duration too long, did not allow the students to work at the site alone, focused only in one department, they have to handle outspoken users and takes longer time to adapt to WBL environment.
Advantages	Authentic experience, offers opportunity to develop generic skills, obtains guidance from the mentors, increase chances of employment and independent learning.
Facilities	Internet and equipment manuals

The WBL students' transcripts reveal that they are offered many opportunities to develop their generic skills. Table 5-9 summarises the attributes involved during the skills development (refer to Chapter 5.3.3).

Table 5-9 WBL students' generic skills development (Source: author)

Generic Skills	Generic Skills Development
Aware of Importance	Aware
When it is developed?	RCM, PPM and D&O
Problem-Solving	Understanding the problem, recording problems, solving procedures and progressing in the logbook, finding information, preparing contingency solutions, and being independent.
Verbal Communication	Interacting with the surrounding people directly and via technology, conducting presentations, understanding the presentation contents, explaining with confidence, conversing fluently in English, being aware of individual weaknesses and improving, updating work progress.
Teamwork	Delegating tasks, being aware of own and team member tasks, co-operating, being supportive, sharing ideas, listening and acknowledging the ideas of others.

Table 5-10 presents the summary of generic skills assessment tasks as reported by the students during the interviews (refer to Chapter 5.3.4).

Table 5-10 WBL students' assessment tasks (Source: author)

Generic Skills	Assessment Task
Problem-solving	Discussion, project and logbook writing.
Verbal Communication	Presentation and Q & A
Teamwork	Group presentation, discussion and project

As described in Chapter 5.3.4, Table 5-11 summarises the findings of generic skills criteria for the assessment as reported by the WBL students.

Table 5-11 WBL students' description of generic skills assessment (Source: author)

Generic Skills	Assessment Descriptions
Problem-solving	Process of solving problems, providing numerous solutions, whether or not the problem gets solved within time provided, deciding the best solutions, being independent and recording progress in the logbook.

Verbal Communication	**During presentation –** being able to converse in English, knowledgeable on the presentation topics. **Discussion and Q & A –** Interacting with people, explaining with confidence, updating work progress, increasing confidence levels, handling and managing situations.
Teamwork	Tasks being fairly distributed, participating, co-operating, following instructions, being supportive.

The following table summarises the generic skills assessment difficulties experienced by the WBL students (refer to Chapter 5.3.5).

Table 5-12 WBL students' generic skills assessment difficulties (Source: author)

Difficulties	CS2
Assessment criteria	Not aware of the criteria, described the criteria as too general
Assessment standardisation	Standardised
Reflection after assessment	No
Supervision during learning	Good supervision from institution, by both WBL coordinator and mentor
Others	Biased

One of the WBL student's transcripts is presented in **Appendix 6B**.

5.4 Findings of Employers' Expectations of Graduates' Generic Skills Attributes

This section presents the findings from five employers selected by the institute's WBL coordinator. All employers have experience of working with a number of graduates from this case study and have years of experience in managerial positions. The interviews are held in the employers' premises. The employers are interviewed to determine their expectations of HE and WBL in enabling students to learn the necessary attributes of generic skills to the correct level of competency. The employers are also asked to reflect on the current and previous mentees' generic skills performance.

Two themes emerge from the scripts: the employers' experiences as well as the generic skills attributes. Accordingly, these findings validate the employers' expectations of the development of these skills and see whether or not they align with HE practice. The results may also contribute to better understanding how to enable students to develop their generic skills and how to assess these skills in a WBL environment.

5.4.1 Employers' Background

Table 5-13 displays the employers' brief biographies. Only one female employer, CS2E4, participated in this case study. Further information of the employers' profiles is presented in Figure 5-14 and Figure 5-15 respectively.

Table 5-13 Employers' biographical background (Source: author)

Participant	Biographical Background
Case Study 2	
CS2E1	He is a 45-year-old. He has been working in this company since 2004 and has been the Assistant Technical Manager for the last 5 years. The main business of this company is maintaining and repairing Bio-Medical equipment in all of the hospitals around the Southern Region of Malaysia. Currently he is responsible for managing more than 20 engineering personnel.
CS2E2	A 30-year-old male. He became an Assistant Technical Manager last year, after 5 years of working in the company. Maintaining and repairing Bio-Medical equipment in all the hospitals around the Central Region of Malaysia are the main business of this company. He currently manages 14 engineering personnel.
CS2E3	He is a 41-year-old. He was appointed as the Technical Manager in 2009. The main business of this company is to supply, maintain and repair dialysis equipment for personal and industry uses. Currently he is managing more than 50 engineering personnel.
CS2E4	She is a 50-year-old. She has 20 years' experience working in a manufacturing company before joining this company as an Assistant HR manager 6 years ago. The nature of the business of her company is maintaining and repairing Bio-Medical equipment in all the hospitals around the Northern Regions of Malaysia. She manages more than 60 engineering personnel.
CS2E5	A 42-year-old Central Zone Technical Manager. He has more than 10 years of managerial experience. His current company acquired a contract with the Ministry of Health Malaysia to maintain and repair Bio-Medical equipment in all government clinics throughout Peninsular of Malaysia as well as the West Coast of Malaysia. He manages 45 engineering personnel.

Note: The year in which the data is collected is 2014.

Data from this section might provide additional input as whether (or not) the number of WBL graduates working in the company as well as the years of experience in a managerial position, might reflect the employers' perceptions of the WBL graduates' generic skills.

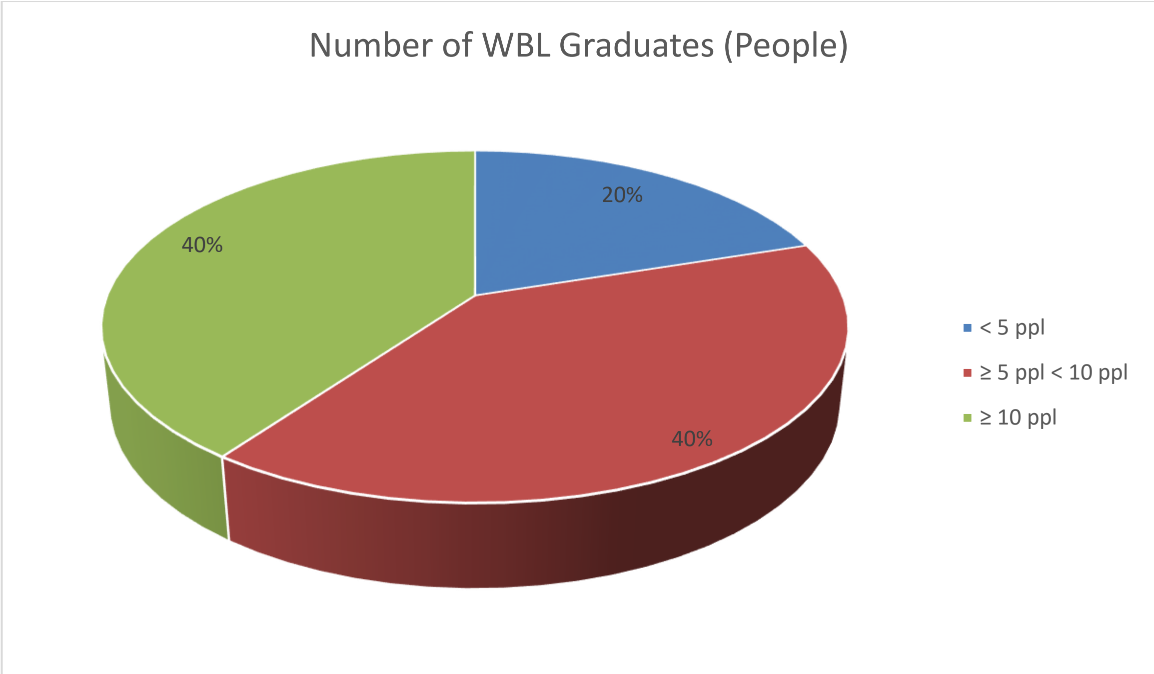

Figure 5-13 Number of WBL graduates the employers have experienced working with (Source: author)

Figure 5-13 shows that only one employer (20%) has experience of working with less than five WBL graduates in his company. Two employers (40%) have experience working with less than ten graduates.

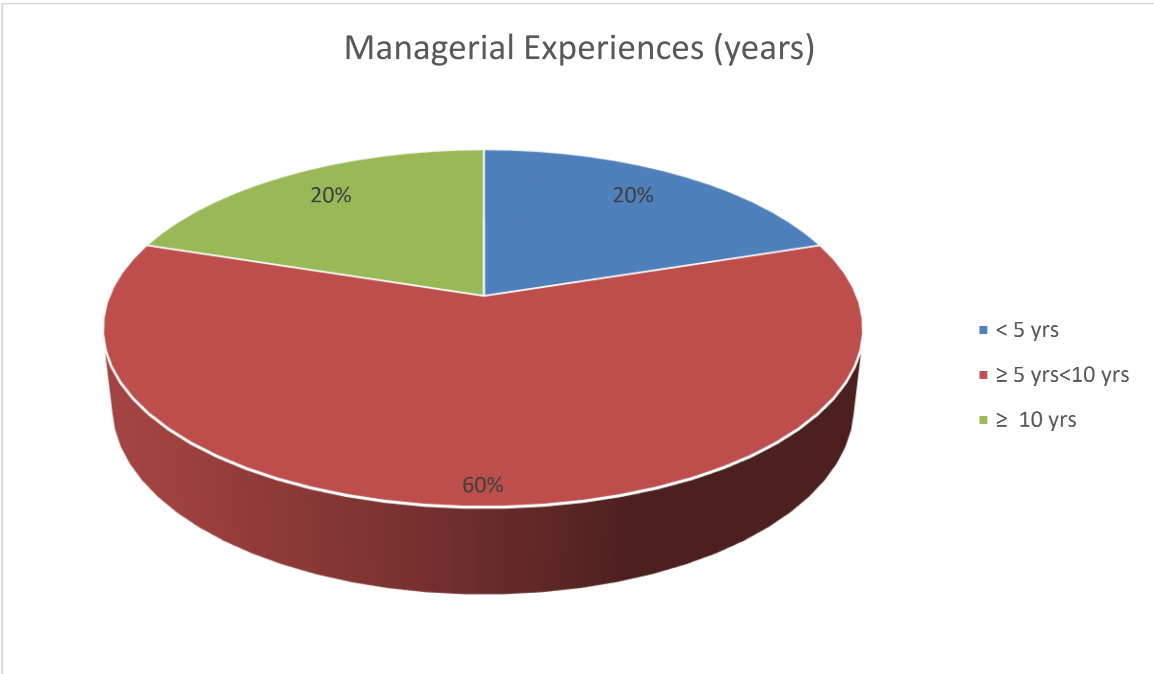

Figure 5-14 Number of years' that employers have held managerial positions (Source: author)

As displayed in Figure 5-14, three employers (60%) have experienced less than ten years in a managerial position in the company. Only one employer (20%) has experienced less than five years and one more than ten years in a managerial position.

5.4.2 Employers' Perceptions of WBL Graduates' Generic Skills

It is reported that only some of the employers provide generic skills training for the students.

> *"We also arranged some induction training for three to four days for new employees. During this training we combined the communication skills training, introduction to their working environment and shared the common problems faced at the site." CS2E1 (45, Assistant Technical Manager)*

> *"Usually for teamwork we conduct a team building camp once a year without family members present." CS2E3 (41, Technical Manager)*

> *"… Soft skills training is provided once a year but the content is not so heavy." CS2E4 (50, Assistant HR Manager)*

There are also employers who expect HE to fully develop the students' generic skills during HE. Cost savings, limited amounts of time and avoiding the engineer from making mistakes are the main reasons for this expectation.

> *"… in the industries, our nature of work involves 40-50% soft skills, so it is not appropriate for the industry to train soft skills in the sense of time and practicality. Another thing, while at work, we will try to minimise our costs and avoid making any mistakes. It is because that any mistakes that you make will cost you money and the company's reputation." CS2E2 (30, Assistant Technical Manager)*

> *"… It is recommended if HE can provide our students with this kind of training, it could make a lot more benefits for the employer. In university, it is acceptable for you to make a mistake, but in industry, any mistakes could minimise the company's profits and even create loss for the company. Not even that, its reputation will also be affected." CS2E3 (41, Technical Manager)*

> *"That is why we expect graduates who are work ready, who require no more training, in the soft skills especially." CS2E5 (42, Central Zone Technical Manager)*

Both technical or generic skills have become main concerns for most of the employers when want to hire the new graduates.

> *"We don't want to hire a worker who can only talk this and that; we want to hire a worker who can do this and that." CS2E1 (45, Assistant Technical Manager)*

> *"For me technical skills and soft skills need to be applied equally during HE." CS2E2 (30, Assistant Technical Manager)*

Only a few employers seem to be satisfied with current WBL graduates' hands-on performance, and this is indicated by the acceptance of the WBL approach in the Bio-Medical industry.

> *"I think Bio-Medical Engineering Education (EE) has rapidly grown in Malaysia and they are on the right track. What EE need to do is to maintain and improvise their approach from time to time to align with the industry's expectations and demands." CS2E1 (45, Assistant Technical Manager)*

> *"What I like most is their knowledge on the theoretical sense, they were much better than their seniors." CS2E3 (41, Technical Manager)*

The employers prefer to hire WBL graduates, because these students have been exposed to the working environment during WBL and are fast learners:

> *"They have recognised the equipment, are familiarised with the environment and have good relationships with the users; that's added advantage to them." CS2E1 (45, Assistant Technical Manager)*

> *"… They can easily adapt to the environment that we want to cultivate; the way we want them to perform. … I noticed that our new graduates can easily learn new things." CS2E3 (41, Technical Manager)*

Common reasons reported by employers for employing WBL students include: being work ready, having good hands-on skills, being more focused and confident. However, CS2E4 states difference preferences in regards to that matter. She prefers to hire diversified personnel, since then there is a range of different mentalities and a blend of understandings.

> *"I don't prefer having all my technical persons graduated from ***; I would prefer a variety of people coming into our company so that we have different mindsets and a blend of understanding." CS2E4 (50, Assistant HR Manager)*

Despite all of the advantages of WBL graduates, there are also concerns on the employers' part which need be considered and which could be improved in HE practice in the future. The employers' complain about academic results, which do not reflect the students' quality and performance. They worry false information is given to employers when selecting their potential engineers.

> *"… Their CGPA results do not reflect the quality of the work. We don't want the students who graduate from ***. It will burden the graduates and employers." CS2E1 (45, Assistant Technical Manager)*

Similarly, CS2E4 feels very frustrated and shares her bad experiences of dealing with students she labels as "bright" students.

> *"Yes, they are good in their academic results but I guess their attitude and respect towards superiors are poor. Previously, during my time, if*

we don’t agree or are dissatisfied with the management, we don’t dare to say anything and we just keep quiet. Graduates, nowadays, if they don’t agree or whatever, they will dispute and argue either with the seniors or the management. They are brave but not in the right place. When we deal with smart or bright graduates, we will find it difficult to give feedback to them because they won’t accept it. They think that they are smart and will not make any mistakes. Yes, I suppose students nowadays are outspoken. I just experienced it in the last few days; I sent a warning email, a normal procedure from HR. He was not satisfied and he has not replied to HR, but replied straight to my boss.” CS2E4 (50, Assistant HR Manager)

Generally, the employers are not impressed by the current graduates’ generic skills quality and performance.

“… Their soft skills levels are not up to our expectation, very disappointing.” CS2E3 (41, Technical Manager)

“When I look back at my experience interviewing the graduates, more or less the quality is decreasing…” CS2E4 (50, Assistant HR Manager)

“… Their generic skills are below average.” CS2E5 (42, Central Zone Technical Manager)

Likewise, CS2E2 and CS2E4 claim that WBL graduates’ thinking skills are not quite as convincing, compared to other engineering graduates.

“For WBL students they didn’t think further.” CS2E2 (30, Assistant Technical Manager)

“I would say WBL students, their thinking skills are quite low…” CS2E4 (50, Assistant HR Manager)

Exam-oriented assessments in the Malaysian education system are reported to contribute to these outcomes. CS2E3 labels the graduates as “bookworms”, where they only learn through reading and memorising contents in the notes and books during HE.

“I think the approach is still similar to what I experienced before at university. Students learn just to pass their exams. We tend to memorise things instead of understanding them.” CS2E3 (41, Technical Manager)

CS2E4 and CS2E5 similarly share the same thoughts on the current education system:

“I guess maybe they are trained in HE to memorise for the sake of the examinations only. After the exams they tend to forget what they have memorised. I can say I have experienced 70-80% our graduates being like that.” CS2E4 (50, Assistant HR Manager)

“The students nowadays learn just to pass their exams…” CS2E5 (42, Central Zone Technical Manager)

CS2E5 also suspects that HE has decreased its standards to allow more students to pass in their studies.

> *"At the same time, letting the standards be dropped down and proud that the pass rates have increased. But in reality the quality of the graduates is decreasing, so sorry to say this." CS2E5 (42, Central Zone Technical Manager)*

The graduates that HE produces have become a concern to CS2E5; he claims that WBL graduates do not know how to apply what they have learnt from HE in the working environment.

> *"What has worried me, I have noticed that what they have learnt, they don't know how to apply in the working environment." CS2E5 (42, Central Zone Technical Manager)*

In addition, CS2E1 is concerned about the WBL graduates' lack of verbal communication skills:

> *"Through my experience working with the WBL graduates, there are some of them who are very shy…" CS2E1 (45, Assistant Technical Manager)*

Having mentioned all the difficulties listed above, the employers make a few recommendations to improve HE Engineering Education in developing students' generic skills. One of the recommendations is that HE should provide guidelines on what attributes students should possess at the end of studying.

> *"HE should be responsible in developing those skills. They should prepare proper guidelines or checklists on what graduates should possess after completing their studies; I didn't see any guidelines before." CS2E2 (30, Assistant Technical Manager)*

CS2E3 suggests that HE should maintain close relationships with industry to benefit from the updated technology and to reflect on previous graduates' performances.

> *"I would love to see HE have a close relationship with industry. In addition to technology updates, we as an employer could provide our latest requirements and feedback on their graduates and, at the same time, to our potential workers on what they need to be equipped with." CS2E3 (41, Technical Manager)*

Regarding employers' practices of assessing their personnel's performance, all the employers report that generic skills (problem-solving, verbal communication skills and teamwork) are among the criteria evaluated during yearly appraisals. The employers also acknowledge that it is hard to assess their engineers' generic skills performance since it is very subjective.

> *"I know it is hard to assess soft skills as they are too subjective. It is based on our observation and judgement." CS2E2 (30, Assistant Technical Manager)*

5.4.3 Employers' Understanding of Generic Skills and Expected Attributes

This section briefly describes the employers' expectations of generic skills and discusses those expectations, particularly regarding the attributes required within the engineering discipline. This information provides the employers' demands for the HE stakeholders to acknowledge and maintain alignment with the learning outcomes as set by the institutions.

a. Problem-Solving Skills

The nature of business for most of the employers in Case Study 2 is supplying, maintaining and repairing Bio-Medical equipment. Engineers are expected to repair broken-down equipment, involving finding the fault, repairing, completing test runs, and proving the equipment has been fixed.

> *"… They need to repair, test run, prove the machine has been fixed." CS2E3 (41, Technical Manager)*

> *"Our tasks are to maintain when it is time to service and repair the equipment when the equipment is broken down." CS2E4 (50, Assistant HR Manager)*

If the problem cannot be solved, the engineers can ask for help from others, such as specialists and vendors.

> *"If any problem faced cannot be solved, an assistant engineer can refer to the senior engineer, and if it still can't be solved they can refer to the specialist." CS2E1 (45, Assistant Technical Manager)*

> *"If we don't know about this, we seek help from someone who knows." CS2E2 (30, Assistant Technical Manager)*

Most of the employers require their engineers to solve the problem or repair broken-down equipment within the given time and budget.

> *"If they can solve the problem as soon as possible and reduce the cost, that is most valuable to the company." CS2E1 (45, Assistant Technical Manager)*

> *"Once we receive the request, we need to respond within two hours, to solve the problem we have 14 days from the day of request." CS2E2 (30, Assistant Technical Manager)*

> *"… How fast you can solve it." CS2E3 (41, Technical Manager)*

CS2E1 states that the company's reputation relies on how fast the job can be delivered by them.

> *"… If you can deliver the job earlier, indirectly you have built up the company's reputation to the users." CS2E1 (45, Assistant Technical Manager)*

Failure to solve the problem or deliver the job within the allocated time not only gives the company a bad reputation but can also lead to penalties from customers.

> *"… In our nature of work, we are bounded by time limits; respond within 24 hours and repair in 3 days. If our technical staff don't respond or repair within the expected time, we are penalised, which means it will incur extra costs." CS2E5 (42, Central Zone Technical Manager)*

Being able to work independently is also identified as one of the critical attributes required by most of the employers when solving the problem.

> *"… Whether the problem is solved by themselves or in consultation with someone, for example by getting help from colleagues or vendors." CS2E2 (30, Assistant Technical Manager)*

> *"If they can do their work independently, then it is proved that they have very good problem-solving skills." CS2E1 (45, Assistant Technical Manager)*

> *"… We need someone who has really good technical knowledge and skills, and soft skills as they need to work alone on site." CS2E5 (42, Central Zone Technical Manager)*

The employers also share their experiences of assessing their engineers' problem-solving skills at yearly appraisals. CS2E2's company considers, for appraisal purposes, criteria such as numbers of problems solved, level of difficulties and challenges faced when solving the problem.

> *"… We will look at the numbers of orders or problems that have been solved. … We will focus on the level of the difficulties of the fault or problem; challenges to solve the problem." CS2E2 (30, Assistant Technical Manager)*

However, CS2E1 assesses his engineers' creativity when finding possible solutions, as these can maximise the company's profits:

> *"Creativity in solving the problem is also considered; for example, modifying the broken parts without ordering a new part from the vendor, so it will save the cost." CS2E1 (45, Assistant Technical Manager)*

b. Verbal Communication Skills

According to CS2E2 and CS2E3, the nature of work for an engineer in their company does not only involve verbal communication with users/customers but with others as well.

> *"… I would say 60% of the nature of work involves verbal communication; for example, communication with the users, vendors, patients, doctors and colleagues." CS2E2 (30, Assistant Technical Manager)*

> *"Communications with the customers are critically important for service engineers because these are their daily routines." CS2E3 (41, Technical Manager)*

Generally, in regards to the customers' interactions, most of the employers share the same thoughts. They suggest that verbal communication can only be established if the engineer is able to maintain good relationships with the users/customers.

> *"… Customers are always right. … The rule is simple, don't ever create problems with the users." CS2E1 (45, Assistant Technical Manager)*

> *"… Establish their relationship with the customers." CS2E3 (41, Technical Manager)*

The employers' interview transcripts also indicate that engineers should know how to handle and manage situations, for example, calming customers when they are upset. The belief is that, if the engineer fails to control the situation, this could affect the company's reputation and, at worst, affect the claim payment.

> *"… When we have an argument with the users, we can't be mad or angry or use a high tone. You just think like this; our job is paid by them because every job that we do will be evaluated and signed by the users. If they don't want to sign, this means we can't claim the work." CS2E1 (45, Assistant Technical Manager)*

CS2E5 describes the above attribute as "damage control":

> *"For example, if there is an issue, they should manage to manipulate the situation and convince the users. I am not saying to lie to the users, but just do some damage control." CS2E5 (42, Central Zone Technical Manager)*

The researcher is also told by the employers that the engineers should be able to identify the customers' personalities. By knowing their personalities, the engineer has a better understanding of how to approach the customers.

> *"We need to understand there is much diversity in human personalities. … The staff members need to identify the right way to approach, to please and to comfort the user." CS2E2 (30, Assistant Technical Manager)*

"For me, get to know your users' interests, and then it will be easier to please or satisfy them." CS2E5 (42, Central Zone Technical Manager)

Besides that, in this type of business, the employers report that they require the engineer to be able to explain technical information to non-technical people and, most importantly, make people understand the things that are being explained.

"… Being able to explain technical things to the users who do not have technical backgrounds. Mostly users have clinical and medical backgrounds, so it is quite challenging to explain technical terms to them." CS2E2 (30, Assistant Technical Manager)

"The customers are not asking about the technical only, sometimes they will ask about the operation and clinical as well." CS2E3 (41, Technical Manager)

In order to do that, graduates should acquire sufficient knowledge if they want to practice verbal communication effectively.

"To have good communication skills and to acquire high confidence in your work, we need to have sufficient knowledge about our working environment." CS2E3 (41, Technical Manager)

"We don't want someone who can talk nonsense; we want the discussion based on facts." CS2E4 (50, Assistant HR Manager)

"… They need to have a very strong knowledge on the Bio-Medical." CS2E5 (42, Central Zone Technical Manager)

Furthermore, most of the employers expect their engineers to be able to update their progress on work verbally with their superior and also the customers.

"Verbal communication skills usually are important before we want to begin the work: asking permission from the customer to start work, explaining what will happen, and, after we have completed the work, explaining what had happened, and so on." CS2E1 (45, Assistant Technical Manager)

"… Being able to explain why the machine is broken down, what the parts need to be replaced and how long it is going to take for the parts to arrive if they are not available in store." CS2E3 (41, Technical Manager)

Being able to convince and negotiate with customers are also reported by the employers as another attribute of verbal communication skills.

"However, they need to be able to negotiate the repairing price…" CS2E3 (41, Technical Manager)

"They need to be able to explain, convince and negotiate with the users in every job. That is why soft skills are very important and in fact is a first priority for us." CS2E5 (42, Central Zone Technical Manager)

Occasionally, engineers are required to conduct customer training in maintaining Bio-Medical equipment.

> *"For the engineers, we expect them to conduct a customer training in the hospital. For whoever is in charge of the machine, they need to create an awareness of the machine." CS2E1 (45, Assistant Technical Manager)*

> *"In user maintenance training, we educate the users by making a presentation on how to handle and maintain the equipment." CS2E2 (30, Assistant Technical Manager)*

The findings from the employers' interviews reveal that their preference language for the engineer to converse in is English, either in the office or on site. However, they identify that, amongst the races in Malaysia, Malay graduates have difficulties in speaking in the English language.

> *"Sorry to say, especially for Malay graduates, they are not able to speak in English fluently, I would say below average." CS2E3 (41, Technical Manager)*

> *"The Malays just use English during the interview and at work, only when needed." CS2E5 (42, Central Zone Technical Manager)*

When the graduates are not able to master the English language, their confidence levels are reported to drop.

> *"When they cannot master the usage of English, indirectly their confidence levels will drop because it requires a lot of thinking before they can answer the question." CS2E3 (41, Technical Manager)*

c. Teamwork Skills

CS2E2 describes the personnel in his department as one team. If any of the team members makes a mistake it is considered as a team failure.

> *"Our principle is that one department is one and, if one of us makes mistakes, it will affect the whole department." CS2E2 (30, Assistant Technical Manager)*

Toleration of members within groups is identified as an attribute of teamwork, based on the employers' interviews.

> *"… Tolerate each other, give and take." CS2E1 (45, Assistant Technical Manager)*

> *"Basically there will someone to help to cover his schedule and that is another teamwork criterion I would consider, toleration among them." CS2E3 (41, Technical Manager)*

Another attributes reported by employers is the willingness to help others:

"… Staff that get less PPM this month will help others who get more PPM, so they will cover each other's backs." CS2E2 (30, Assistant Technical Manager)

"… When one of the team members is facing a problem on site, another personnel who is free at that time should come to back him/her up." CS2E3 (41, Technical Manager)

CS2E1 and CS2E2 shares their experiences of motivating the engineers in developing teamwork skills.

"For me, if we want to ask other people's help, we need to help others first." CS2E1 (45, Assistant Technical Manager)

"Feel free to ask if any colleagues need help with their work." CS2E2 (30, Assistant Technical Manager)

CS2E2 expects his engineers to actively participate during group work, especially during discussions.

"We expect them to be actively participating during discussion and during work." CS2E2 (30, Assistant Technical Manager)

It is common to have disagreement among group members during group work. Sometimes, it requires the leader to restore the peace when the situation becomes difficult.

"When disagreement happen, it will create dissatisfaction with for both sides. Sooner or later it will affect the relationship. We try our best to harmonise the staff relationships." CS2E3 (41, Technical Manager)

Engineers' tasks are planned earlier by the coordinator. It is important that the engineer is able to follow the plan and the instructions from their superior. However, if they do not manage to follow the plan, they are required to update his/her superior regarding any changes.

"… They need to inform their supervisor on the changes." CS2E3 (41, Technical Manager)

"… We look at whether or not staff can follow the schedule and management instructions." CS2E5 (42, Central Zone Technical Manager)

5.4.4 Summary of Employers' Expectations of Graduates' Generic Skills Attributes

All in all, the employers' perceptions of WBL graduates is summarised in Table 5-14 (refer to Chapter 5.4.2).

Table 5-14 Employers' perceptions of WBL graduates' generic skills (Source: author)

<table>
<tr><th colspan="2">Description</th><th>Perception</th></tr>
<tr><td colspan="2">Further generic skills training</td><td>Only one employer provided – time, cost and no mistakes</td></tr>
<tr><td colspan="2">Technical vs generic skills</td><td>Both are important</td></tr>
<tr><td rowspan="3">Strengths</td><td>Technical knowledge and skills</td><td>Improving</td></tr>
<tr><td>Generic skills</td><td>Good problem-solvers</td></tr>
<tr><td>Others</td><td>Work ready, fast learners, focused, confident</td></tr>
<tr><td rowspan="4">Weaknesses</td><td>Graduates qualities</td><td>Below average – HE have lowered their standards</td></tr>
<tr><td>Verbal communication skills</td><td>Poor English-speaking skills and failure to explain a subject briefly</td></tr>
<tr><td>Academic result does not represent generic skills performance</td><td>Yes</td></tr>
<tr><td>Others</td><td>Bad attitude, lack of thinking skills, exam-oriented graduates</td></tr>
<tr><td colspan="2">Recommendations</td><td>Update requirements with industry, require graduates to improve generic skills performance, HE to provide more in developing GS.</td></tr>
</table>

The findings for generic skills attributes established from the employers' interviews can be summarised in Table 5-15 (refer to Chapter 5.4.3).

Table 5-15 Summary of employers' descriptions of WBL graduates' generic skills attributes (Source: author)

Generic Skills	Attributes Description
Problem-solving	Working independently, solving problems within time and budget, being resourceful, thinking, talking and deciding, making sure there is continuous improvement and being creative.
Verbal Communication	Being able to: explain briefly in English, interact with technical and non-technical people, answer questions, convince and negotiate, conduct presentations, be confident in handling and managing situations, be aware of users' attitudes and personalities, update work progress verbally and acquire sufficient knowledge.
Teamwork	Feeling responsible for own and other members' tasks, being tolerant, being willing to help others, discussing, active participation during group work, being comfortable with disagreement, updating his/her superior of individual work status.

One of the employer’s transcripts is presented in **Appendix 6C**.

5.5 Summary

This chapter describes the case study conducted in another HE institution in Malaysia (WBL). The qualitative research is employed through semi-structured interviews involving three stakeholders (lecturers, students and employers). The objective is to explore the existing methods of assessing generic skills within an AL environment in Malaysian Higher Education institutions. The next section presents a cross-case comparison of both case studies.

Table 5-16 Second case study (WBL) curriculum alignment matrix (Source: author)

Generic Skills	Intended Learning Outcomes	Learning Activities	Assessment Tasks and Assessment Criteria				
At the end of this module, students should be able to:			**Presentation**	**Observation**			
1. Communication (oral/verbal)	Communicate effectively with the engineering community and the society at large.	• Presentation	• Contents, time management, language, delivery, visual and overall success				
2. Problem-Solving	Identify and provide creative, innovative and effective solution to various problems independently with minimal supervision.	• Discussion • Practical • Quiz • Test End of Chapter	• Present and analyse data and information	• Identify and define key issues and/or problem statement • Apply multidimensional approach/consider context • Demonstrate sound reasoning and conclusions			
3. Team Working	Demonstrate effective leadership and teamwork responsibility	• Briefing theory • Demonstration • Experiment • Discussion • Practical		• Participate as a team member • Guiding/coaching team members • Discussion • Work with cultural diversity			

6 Cross-Case Study: Generic Skills Assessment (GSA) within an Active Learning (AL) Environment

6.1 Introduction

The intention of this chapter is to compare and contrast the generic skills assessments experienced by the lecturers/mentors and students for both case studies. Similarly, it is also to provide the employers' reflections regarding current engineering graduates and their expectations of graduates' generic skills attributes. The summary tables of each theme present the cross-case comparison where the columns are case studies, and the rows are related attributes and findings.

6.2 Cross-Case Studies Comparison

6.2.1 Lecturers' and Mentors' Experiences of GSA

Table 6-1 summarises the cross-case comparison for teaching practices within PBL and WBL in both case studies **(Case Study 1 – CS1 and Case Study 2 – CS2)** discussed in Chapter 4 and Chapter 5.

Table 6-1 Lecturers' and mentors' cross-case comparison – teaching practices within AL (Refer to Table 4-2 and 5-2) (Source: author)

Description		CS1	CS2
AL Awareness	**Approach**	PBL	WBL
	AL Implemented	2010	2010
	Training	Yes (1-day)	Yes (3 days)
	Understanding	Not clear	Not clear
	Written Guidelines	No	Yes
	Institution Supervision	No	Yes, together with WBL coordinator
Students' Learning	**Learning Motivation**	Solving problems	Performing work
	Venue	Classroom	Hospital
	Time	Every subject	During D&O, PPM and RCM
	Challenges	Minimal acceptance by the students, lack of facilities, limited time to prepare.	Take time to adapt to the environment, not allowed to work alone on site.
	Advantages	Informal class environment, improved knowledge and skills, able to refer to multiple sources of information,	Offer more opportunities to learn, improved knowledge and skills, authentic experience, active

		student-driven, motivated students' learning.	students, reduce mentors' workload.

Table 6-1 presents the lecturers' and mentors' teaching practices within the PBL and WBL environment. Both case studies implemented PBL and WBL in 2010. Although AL training is reported to be provided in both case studies, most of the lecturers and mentors claim that they have insufficient knowledge and information in conducting the approach. In conducting AL, PBL in CS1 is implemented in the HE learning institute itself; whereas WBL is conducted in the industry (the hospital environment). With regards to students' learning, it is clearly found that CS1 motivates their students' learning through solving problems, constructed in the problem statement, while CS2's problem-solving skills are developed when the students are performing work on site. Generally, CS2 seems to have implemented AL in a more systematic way than CS1, since longer training duration and written guidelines are provided to the mentors to establish WBL knowledge. Furthermore, CS1 has no institution supervision, but CS2 has, together with WBL-coordinator supervision. Regarding challenges, CS1 is only minimally accepted by students, there is a shortage of facilities, and students face inadequate time to prepare. Meanwhile, for CS2, the challenges include students taking a longer time to adapt to the working environment and not being allowed to work alone on site. Next, the advantages discovered for CS1 include: the informal class environment, improved knowledge and skills, being able to refer to multiple sources of information, student-driven learning, and students are motivated to learn. For CS2, on the other hand, the advantages are seen to be that students: receive more opportunities to learn, are improved in knowledge and skills, have authentic experiences, are active, and, in addition, students' involvement working on site causes a reduction in the mentors' workload.

Based on the lecturers' and mentors' interview data discussed in Chapter 4.2.3 and Chapter 5.2.3, Table 6-2 consolidates all the activities involved in instilling students' generic skills.

Table 6-2 Lecturers' and mentors' cross-case comparison – generic skills development (Refer to Table 4-3 and 5-3) (Source: author)

Generic Skills	CS1	CS2
Problem-Solving	Identifying the problem, solving authentic problems, using 3 K's method, being resourceful, preparing possible solutions.	Identifying the problem, solving the problem within time and budget, being independent, convincing people, being resourceful, preparing possible solutions and logbook writing.
Verbal Communication	Presenting and demonstrating, explaining fluently in English,	Interacting with people, handling situations, explaining in fluent

	discussing, interacting with people directly and via technology, updating the project's progress verbally.	English, conducting a presentation, identifying users' backgrounds, negotiating, maintaining good relationships and listening as well as acknowledging the users.
Teamwork	Presenting and discussing in groups, focus on task objective, delegating tasks, being aware of individual and other members' roles, building co-operation, sharing knowledge and ideas, updating individual progress.	Co-operating, delegating tasks, giving and following instructions, supporting each other, sharing knowledge and ideas, updating individual progress.

Looking closely at the PBL approach used in CS1, the above table shows that generic skills, such as problem-solving, have a lot in common to those in the WBL approach, used in CS2, such as identifying problems, being resourceful and preparing possible solutions. Next, moving on towards verbal communication, lecturers in CS1 place more stress on presentations and demonstrations, as well as verbally updating the project's progress, while mentors in CS2 focus more on understanding people by negotiating, maintaining good relationships, as well as listening and acknowledging them. Concerning teamwork, CS1 lecturers emphasise group presentations, discussions, delegating tasks, while the mentors in CS2 also focus on similar aspects of giving and obeying instructions and building co-operation.

Table 6-3 summarises the assessment tasks conducted by the lecturers and mentors in both case studies.

Table 6-3 Lecturers' and mentors' cross-case comparison – assessment tasks (Refer to Table 4-4 and 5-4) (Source: author)

Generic Skills	CS1	CS2
Problem-Solving	Presentation and Q & A	Discussion, project and logbook writing
Verbal Communication	Demonstration, presentation and Q & A	Presentations (daily, TAR and EI), discussion and Q & A
Teamwork	Group presentation, project and Q & A	Group discussion and project

Looking at the above table (Table 6-3) and the assessment tasks carried out by the two case studies, with regards to problem-solving, CS1 uses presentations as well as Q & A; while CS2 uses discussion, project and logbook writing. Moreover, with regards to verbal communication, CS1 lecturers utilises demonstration and presentation, as well as Q & A. CS2, on the other hand, utilizes presentations (daily, TAR and EI), discussion and Q & A in their assessment tasks. Likewise, the tasks carried out by the lecturers for teamwork in CS1 consist of group presentation, project and Q & A, while CS2 mentors use group discussion and project only.

Table 6-4 Lecturers' and mentors' cross-case comparison – generic skills assessment attributes (Refer to Table to 4-5 and 5-5) (Source: author)

Generic Skills	CS1	CS2
Problem-Solving	Reasoning skills, being able to find information, applying previous knowledge and skills, being able to solve the problem.	Identifying the problem, preparing contingency solution, convincing, verifying decision with superior, being independent, solving the problem within time, users' feedback and satisfaction.
Verbal Communication	Being fluent and having an appropriate use of the English language, understanding the content of the presentation, having good confidence levels, being able to answer questions, being prepared.	Being able to manage to answer questions, establishing verbal communication with the surrounding people, having feedback from users, following mentor's guidance; conversing in English.
Teamwork	Working in a group, participating, sharing knowledge, helping others, fairly distributing tasks, feeling individual responsibility.	Individual mark, sharing ideas, giving and obeying instructions, being aware of own roles, delegating tasks, being co-operative and supportive.

Table 6-4 compares the generic skills assessment attributes reported by the lecturers and mentors. It can be observed that emphasis is put on the generic skills, such as problem-solving, verbal communication and teamwork. According to the lecturers in CS1, the attributes of reasoning skills, the ability to find information, the ability to apply previous knowledge and solve problems contribute to the problem-solving skills assessment. On the other hand, mentors in CS2 concentrate its assessment on attributes of identifying the problem, the ability to prepare contingency solutions, the ability to convince and be independent, the ability to solve the problems within the time given, and to obtain users' feedback satisfaction. Furthermore, verbal communication assessment for CS1 involves attributes, such as fluency in the English language, understanding the content of the presentation, being able to answer the questions, being fully prepared and having a high confidence level. Similarly, CS2 mentors concentrate on attributes such as: conversing in good English, managing to answer questions effectively, establishing verbal communication with surrounding people surroundings, and following their mentor's guidelines. Next, for teamwork, CS1 lecturers report that they assess attributes of: being able to work in a group, participating actively, being able to share knowledge, always helping others, making sure tasks are fairly distributed and being aware of his/her individual responsibilities. Correspondingly, CS2 mentors claim the assessment involves individual assessment, being able to share ideas, being able to obey instructions, having awareness of individual roles, delegating tasks as well as being co-operative and supportive in group work.

Table 6-5 Lecturers' and mentors' cross-case comparison – generic skills assessment challenges (Refer to Table 4-6 and 5-6) (Source: author)

Challenges	CS1	CS2
Training	Not provided	Not provided
Limited time	Yes	Yes
Assessment Scheme	Not provided	Provided but too general (Rubric)
Assessment Method	Lecturers' observations	Mentors' observations
Industry Feedback	No	Yes

Table 6-5 outlines the challenges faced by the lecturers and mentors in generic skills assessment. One of the lecturers in CS1, CS1L1 strongly claims that there are no specific tools to observe students' performances in developing generic skills, which lead to the non-standardised assessment approaches amongst the lecturers in CS1.

> *"… There is no schematic assessment, no assessment sheet stated what the portions are of those soft skills and no criteria being stated that represent those skills. … We don't have a specific tool to measure how far they have improved in their soft skills." CS1L1 (5 years' teaching experience, 2 years' industry experience)*

Other challenges are met when exercising general skills assessments, especially in training, schemes, methods as well as a lack of time and presence of industry feedback. Firstly, both CS1 and CS2 lecturers and mentors are not provided with any assessment training, as well as having a lack of time. The assessment scheme differs, as CS1 lecturers are not provided with an assessment scheme, while CS2 mentors are provided with an assessment tool but it is reported as being too general. Next, the assessment methods exercised in CS1 are through the lecturers' observations, while in CS2, the mentors' observations are given authority. CS1 also differs from CS2, as lecturers do not receive any feedback from the industry while CS2 mentors do receive feedback. This is probably because learning in CS2 took place in the industry and therefore the feedback can be easily highlighted to students.

6.2.2 Students' GSA Experiences

Table 6-6 summarises the students' learning experiences within an active learning environment for both case studies.

Table 6-6 Students cross-case comparison – students' learning within an AL environment (Refer to Table 4-8 and 5-8) (Source: author)

Description	CS1	CS2
AL Experience Previously	None	None
AL Training	Provided – 1 day (Induction week)	Provided – 1 week
Written Guidelines	No	Yes
Venue	Classroom	Hospital (4 locations)
Time	Every subject	During D&O, PPM and RCM
Challenges	Time constraint, lacked lecturer guidance, learning approach not standardised, plagiarism and non-active students were disadvantaged.	WBL duration too long, did not allow the students to work on site alone, focused only in one department, have to handle outspoken users and takes a longer time to adapt to WBL environment.
Advantages	Motivate students' learning, offer the opportunity to develop generic skills, active participation, interesting and fun environment, easy to understand the knowledge.	Authentic experiences, offer the opportunity to develop generic skills, obtain guidance from mentor, increase chances of employment and independent learning.
Facilities	Internet, library books, engineering manuals and catalogues	Internet and equipment manuals

Students from both CS1 and CS2 are given AL training; the CS1 students are provided with one day's training, while CS2 students are trained in AL for a whole week. Written guidelines are provided in CS2, while in CS1 they are not. Moreover, the challenges that the CS1 students faced are: the lack of time and lecturer guidance, the non-standardised learning approach, the potential for plagiarism, as well as non-active students being put at a disadvantage. Likewise, CS2 students also experience challenges, mainly concerning the WBL duration being too long, as well as the students' inability to adapt quickly in WBL. Conversely, the advantages that the CS1 students gain include: being motivated to learn, having opportunities to develop their generic skills, being in a fun and interesting environment, and the approach being easy to understand. CS2, however, provides its students with authentic experiences, also offers opportunities to develop generic skills, increases the chances of employment and encourages independent learning. The facilities provided for both CS1 and CS2 differ, as CS1 students are equipped with the Internet and library books, as well as engineering manuals and catalogues. CS2 students are only equipped with Internet and equipment manuals.

Table 6-7 Students' cross-case comparison – generic skills development (Refer to Table 4-9 and 5-9) (Source: author)

Generic Skills	CS1	CS2
Aware of Importance	Aware	Aware
When are they developed?	PBL sessions	RCM, PPM and D&O
Problem-Solving	Solving the problem within time, understanding the problem, applying 3 K's, finding information, discussing, justifying the findings, preparing contingency solutions, deciding the best solution, presenting the outcome to the class and answering questions.	Understanding the problem, recording problem-solving procedures and progress in the logbook, finding information, preparing contingency solution and being independent.
Verbal Communication	Conducting presentation, convincing and engaging with the audience, applying various methods of presentation, conveying information, making people understand with explanations, fluency when conversing in English, interacting with surrounding people, demonstrating projects, discussing, updating work progress.	Interacting with surrounding people directly and via technology, conducting presentations, understanding the presentation contents, explaining with confidence, fluency when conversing in English, being aware of individual weaknesses and trying to improve them, updating work progress.
Teamwork	Selecting team members, delegating tasks, brainstorming, discussing, sharing ideas, co-operating, being respectful and maintaining good relationships, and being tolerate of team members.	Delegating tasks, being aware of own and team members' tasks, co-operating, being supportive, sharing ideas, listening and acknowledging others' ideas.

The above table summarises the students' experience when developing their generic skills. It can be clearly deduced from the table that both CS1 and CS2 students are aware of the importance of instilling generic skills in HE. The time in which these skills are developed is another different topic; as generic skills are developed during PBL sessions for CS1 students, while CS2 students develop their generic skills during RCM, PPM and D&O. Furthermore, when we look at problem-solving for CS1 students, they develop the skills through solving the problem within the given the time, understanding the problem, applying the 3 K's, finding and discussing information, justifying the finding and so on. For CS2 students, they focus more on understanding the problem, recording problem-solving procedures and progress in the logbook, finding information, preparing contingency solutions and being independent. Next, looking at verbal communication for CS1 students, it can be said that the skills are developed when conducting presentations: engaging and convincing the audience, applying various methods of presentation, being fluent when speaking in English, and other activities that further develop their soft skills. Similarly, CS2 students also develop their verbal communication skills through interacting with surrounding people, directly and via technology, through conducting presentations, as well as being aware of their weaknesses and improving them. After that, teamwork is given emphasis, as CS1 students focus on selecting team members, delegating tasks, brainstorming and having discussions. CS2 students develop teamwork also through delegating tasks, being aware of individual and others' tasks, being supportive as well as listening and acknowledging other members' ideas.

Table 6-8 Students' cross-case comparison – assessment tasks (Refer to Table 4-10 and 5-10) (Source: author)

Generic Skills	CS1	CS2
Problem-solving	Presentation, Q & A and progress report	Discussion, project and logbook writing
Verbal Communication	Presentation, discussion and Q & A	Presentation and Q & A
Teamwork	Group presentation and project demonstration	Group presentation, discussion and project

Table 6-8 places emphasis on the assessment tasks, concentrating on the generic skills: problem-solving, verbal communication and teamwork. The assessment tasks practised in CS1 for problem-solving include presentations, Q & A, and progress reports. CS2, on the other hand, utilises discussions, project and logbook writing. For verbal communication, CS1 students are tasked with presentations, discussions, as well as Q & A, while the students in CS2 are tasked with presentations and Q & A only. Teamwork again played a major part in assessment tasks, as students in CS1 are assessed in group presentations and project demonstrations; while the students in CS2 are assessed in group presentations, discussions and projects.

Table 6-9 Students' cross-case comparison – generic skills assessment attributes (Refer to Table 4-11 and 5-11) (Source: author)

Generic Skills	CS1	CS2
Problem-solving	The process of finding solutions, the number of solutions, whether or not the problem is solved in the end, reasoning skills, level of confidence.	The process of solving problems, providing numerous solutions, whether or not the problem gets solved within the time provided, deciding the best solutions, being independent and recording progress in the logbook.
Verbal Communication	**During presentation** – eye-to-eye contact, facial expression, body language, the tone of voice, enthusiasm, being able to converse in English, presentation approach, contents of the slides, further elaboration of each point in the slide and audience engagement. **Discussion and Q & A** – being able to answer questions, able to make others understand what they deliver, knowledge contribution and interacting with others.	**During presentation** – being able to converse in English, knowledgeable on the presentation topics. **Discussion and Q & A** – interacting with people, explaining with confidence, updating work progress, increasing confidence levels, handling and managing the situation.
Teamwork	Progress updates, group leader feedback, students' ability to work in a group, participating, knowledge sharing, willing to help others, distributing tasks fairly and individual responsibility.	Distributing tasks fairly, participating, co-operating, obeying instructions, being supportive.

Referring to Table 6-9, here the focus is on generic skills assessment attributes in problem-solving, verbal communication and teamwork. It should be pointed out that the descriptions are based on students' assumptions of how generic skills assessments are conducted. For problem-solving in CS1, the students thought the emphasis is put on the process of finding solutions without there being too much consideration of whether or not the problem is solved, on reasoning skills as well as the level of confidence. CS2 students, however, focuses on the process of solving problems, providing numerous solutions without giving too much consideration on whether they are successful, deciding the best solutions, being independent as well as recording all progress in the logbook. After that, for verbal communication, for the CS1 students, the focus is divided into two parts; namely during presentations and the discussion, as well as the Q & A sessions. During presentations, CS1 students are detailed in their delivery as they consider eye-to-eye contact, facial expression, the tone of voice and body language, fluency in English, presentation approaches, as well as making sure that they elaborate all the points. CS2 students focus on their fluency in English, as well as making sure that they are knowledgeable about their topics. On the other hand, during discussion and Q & A sessions, CS1 students are able to answer the questions, make the audience understand what they deliver and interacted with the audience. Correspondingly, CS2 students interact with people, increase their confidence levels and gain new experiences in handling and managing situations. In the matter of teamwork, CS1 students make updates on their progress, receives feedback from the group leader, makes sure that the tasks are fairly distributed, and that everyone knows their responsibilities. CS2 students, on the other hand, make sure that everyone participates, co-operates, distributes the tasks fairly and obeys all the instructions given.

The following, Table 6-10, summarises the comparison of generic skills assessment difficulties faced by students in both case studies.

Table 6-10 Students' cross-case comparison – generic skills assessment difficulties (Refer to Table 4-12 and 5-12) (Source: author)

Difficulties	CS1	CS2
Assessment Criteria	Not aware of the criteria and, when and how the assessment should be conducted, described the criteria too generally	Not aware of the criteria, described the criteria as too general
Assessment Standardisation	Not standardised	Standardised
Reflection after Assessment	No	No
Supervision during Learning	Lack of lecturer supervision	Good supervision from institution, by both WBL coordinator and mentor
Others	Unfair assessment, lecturer lacked awareness of individual performance, biased	Biased

Looking at the above table, the major points that are highlighted consist the assessment criteria, assessment standardisation, reflections after assessment, supervision during learning, as well as other influences. Firstly, both the CS1 and CS2 students face difficulties in terms of assessment criteria, as they are not aware of the criteria and the criteria is poorly described and is too general. Secondly, the CS1 students have no standardised assessments, while CS2 students have experienced standardised assessments. Thirdly, both the students in CS1 and CS2 have no post-assessment reflections. Fourthly, CS1 students face difficulty in supervision during learning because of the lack of supervision by the lecturers. In contrast, CS2 students receive good supervision from the institution by both their WBL coordinator and mentor. The other factors influencing CS1 students include unfair assessments, the lecturers' lack of awareness of individual performances and bias. Similarly, factors influencing CS2 students involve bias.

6.2.3 Employers' Expectations of Engineering Graduates' Generic Skills Attributes

Industries are changing in response to the competitive pressures and the rapid deployment of technologies. Appropriate generic skills assessment in HE should reveal individuals' performance and achievements which later provide useful information to both individuals and potential employers, identifying areas of strengths and weaknesses. False or inaccurate information may cause wrong judgements by employers when selecting their future engineers.

Table 6-11 Employers' cross-case comparison – employers' perceptions of AL graduates' generic skills (Refer to Table 4-14 and 5-14) (Source: author)

<table>
<tr><th colspan="2">Description</th><th>CS1</th><th>CS2</th></tr>
<tr><td colspan="2">Further generic skills training</td><td>Not provided – time and cost</td><td>Only one employer provided – time, cost and no mistakes</td></tr>
<tr><td colspan="2">Technical vs. generic skills</td><td>Both are important</td><td>Both are important</td></tr>
<tr><td rowspan="3">Strengths</td><td>Technical knowledge and skills</td><td>Good</td><td>Improving</td></tr>
<tr><td>Generic skills</td><td>Good problem-solvers, excel in critical thinking and can work in a team</td><td>Good problem-solvers</td></tr>
<tr><td>Others</td><td>Independent, obey instructions</td><td>Work ready, fast learners, focused, confident</td></tr>
<tr><td rowspan="4">Weaknesses</td><td>Graduates qualities</td><td>Decreasing</td><td>Below average – HE have lowered standards</td></tr>
<tr><td>Verbal communication skills</td><td>Failure to update progress, poor English-speaking skills and failure to explain a subject briefly</td><td>Poor English-speaking skills and failure to explain a subject briefly</td></tr>
<tr><td>Academic result does not represent generic skills performance</td><td>Yes</td><td>Yes</td></tr>
<tr><td>Others</td><td>Bad attitude and expect high starting salaries.</td><td>Bad attitude, lack of thinking skills, exam-oriented graduates</td></tr>
</table>

Recommendations	Expose the students and lecturers to the current industry problems, establish collaboration with industry	Update requirements with industry, require graduates' generic skills performance, HE to provide more in developing GS

The employers' perceptions have a large role in the lives of AL graduates, because graduates need to acquire jobs after education and employers need to be satisfied with the quality of the graduates. Table 6-11 presents the employers' perceptions of AL graduates' generic skills performance. First of all, for CS1 employers, further generic skills training is not provided to the fresh graduates. In CS2 training is provided by one employer only. CS1 and CS2 employers, however, share the same thoughts regarding the importance of technical skills and generic skills. They describe both skills as equally important for the graduates to survive in their careers. When looking at the strengths of the CS1 graduates, it seems that they have good technical and knowledge skills, possesses good generic skills, such as: being good problem-solvers, excelling in critical thinking, being able to co-operate, being independent and being able to obey instructions. Correspondingly, CS2 graduates have improved in technical and knowledge skills, are good problem-solvers, fast learners, confident and work ready. When considering the weaknesses of CS1 graduates, employers feel that the graduates' qualities are decreasing, that they have bad soft skills, their academic results do not reflect their generic skills, they have bad attitudes and require high starting salaries. The same can be said of CS2 graduates as the qualities are below average, they have bad soft skills, their academic results do not reflect their generic skills, some have bad attitudes, lack thinking skills and are exam-oriented. Furthermore, to counter these issues, some recommendations are made. For employers in CS1, it is recommended for students and lecturers to be exposed to current industrial problems to encourage thinking skills as well as establishing collaborations with industries. Meanwhile, for CS2 employers, they highlight that industrial requirements should frequently be updated to identify what the employers want from graduates.

Table 6-12 Employers' cross-case comparison – employers' expectations of generic skills attributes (Refer to Table 4-15 and 5-15) (Source: author)

Generic Skills	CS1	CS2
Problem-solving	Solving problems within the time and funds given, focus on objective, having macro perspective, understanding the problem, finding the cause and solution (thinking, talking and deciding), being creative, having a contingency plan, being independent, acknowledging superiors, being resourceful, trying to minimise errors, and handling and managing situations with composure.	Working independently, solving the problem within time and budget, being resourceful, thinking, talking and deciding, making sure there is continuous improvement and being creative.
Verbal Communication	Presenting, reporting, interacting with multi-(disciplinary/racial/level/nationality) personnel, discussing, understanding customers' needs, convincing, negotiating, fluency in English language, being multilingual, maintaining good relationships with customers, communicating verbally via the social network, and having a clear voice tone.	Being able to: explain briefly in English, interact with others, answer questions, convince and negotiate, conduct presentations, and be confident in handling and managing situations, aware of users' attitudes and personalities, being able to update work progress verbally and acquire sufficient knowledge.
Teamwork	Co-operating, giving and obeying instructions, sharing ideas, completing the tasks sooner but maintaining the quality, delegating tasks fairly, being aware of individual and other members' tasks, updating progress regularly, being supportive.	Feeling responsible for own and other members' tasks, being tolerant, willingness to help others, discussing, actively participating during group work, being comfortable with disagreement, updating his/her superior with individual work status.

Employers' perceptions of generic skills and their attributes are presented in Table 6-12, based on the data from employers' interview transcripts. The main points of the attributes involve generic skills, such as problem- solving, verbal communication and teamwork. For problem-solving, CS1 employers expect graduates to have the abilities to solve problems within the time and the given budget, find the cause and solution to the problem, be independent and creative, be resourceful, acknowledge their superiors, try to minimize errors, as well as being able to handle and manage situations with composure. For CS2 employers, they prefer their potential employees to be able to work independently, solve problems within the given time and budget, be resourceful and creative and to make sure that there is continuous improvement. Furthermore, for verbal communications, CS1 employers look for graduates to have abilities of being able to: deliver presentations and reports, hold interactions with people of different social status and background, manage discussions, speak English fluently, be multilingual, and maintain good relationships with customers. Similarly, CS2 employers share almost the same expectations, where they require graduates to be able to: explain something in English briefly, interact with others, speak fluent English, answer questions, be aware of people's attitudes and personalities, as well as be confident in handling and managing different situations. Teamwork also plays a huge role in the working environment, as described by the employers in CS1. They describe that graduates are expected to be able to co-operate, give and obey instructions, share ideas, complete tasks swiftly, be able to delegate the tasks, as well as updating on task progress regularly. CS2 employers require graduates also to be able to maintain good relationships with others, share ideas, update on progress regularly, tolerate and co-operate, as well as being supportive of each other.

6.3 Summary

This chapter provides a cross-case study comparison to identify similarities and differences in generic skills assessments experienced by the lecturers/mentors and students for both case studies. Similarly, it also details the employers' expectations of engineering graduates' generic skills attributes. The outcome of this chapter is used for the discussion of the findings and developing a generic skills assessment framework, which is the subject of the next chapter.

7 Discussion of Findings

7.1 Introduction

This section provides a summary of the findings that have been obtained from the collated data. Please note that the researcher refers to lecturers/mentors as academic staff in the discussion in this section. Five research questions, stated in Chapter 3, have been explored by identifying how AL and generic skills assessments are conducted in HE, from the perspective of academic staff and student, and what generic skills attributes employers expect engineering graduates to possess.

The discussions for this thesis are written in a way to understand whether or not the alignment between HE and industry is being sustained, and the contents of the curriculum agreed by the stakeholders. Semi-structured interviews are employed to help investigate generic skills (problem- solving, verbal communication and teamwork) assessment within an active learning environment in two Malaysian Higher Education institutions (involving 16 students and 14 academic staff) and to acknowledge the employers' expectations (ten employers) regarding the attributes of those skills. Through data collected from the three stakeholders, the researcher consistently investigates and juggles for what works best using the NVIVO software, what can be improved and what new attributes of generic skills should be considered for aligning assessment with learning and teaching activities.

7.2 Development of the GSA Framework

Reflection 1 – Lack of standardisation and monitoring

The researcher's analysis from the academic staff interviews is that, with the limited knowledge that the academic staff have, there are no standardisations in implementing AL and assessing generic skills. Academic staff are more comfortable emphasising the development of technical skills (Cajander et al., 2011). In addition, the lack of clear policies and guidelines from the respective institutions in AL implementation act as a discouragement (or disincentive) to staff (Watisin et al., 2014). This feeling is also supported by the majority of the academic staff still being "traditional" in teaching and in their assessment approaches of students' generic skills. Knight et al. (2007) described one of the problems with the assessment of generic skills as not being amenable to assessment as is conventionally understood.

Time is one of the major issues faced by academic staff regarding implementing AL and assessing the students. According to Trowler (2010), time is considered as one measurement to determine students' engagement and performance in learning; hence a sufficient time allocation for the subject is critically important to motivate students' learning. Besides supervising the students, academic staff are required to teach and also have other essential tasks, which create even more time pressures. These workloads constrain academic staff in fully implementing AL in their subjects and assessing students' performance. Thus, to enhance the competency of academic staff, the institutions should provide appropriate training and courses for them (Rasul et al., 2014).

Surprisingly, the researcher also identifies that there is no single feedback or reflection in both case studies regarding the students' or graduates' generic skills performance, for accountability and quality assurance purposes, and whether or not the active learning is helping students to improve developing those skills. Yorke (2006) and Moalosi et al. (2012) argued that there is a correlation between quality assurance and graduates' generic skills as they are both used to evaluate the academic programmes' effectiveness. The effectiveness of such practices is rarely measured qualitatively or quantitatively, and activities are rated as successful based on academic staff teaching experiences (Rigby et al., 2009). Lack of supervision by both case study institutions in monitoring academic staff in AL and assessment implementation has led assessments to deviate from their original objectives.

Reflection 2 – Lack of generic skills assessment training

The findings show that there is a lack of generic skills assessment training given to academic staff and this contributes to inconsistencies in its implementation. These factors result in academic staff each having his or her own interpretation in understanding and implementing the assessment of generic skills. One of the most obvious challenges is that many educators have an intuitive grasp of what generics skills are, but struggle to give a clear definition of the skills and to define the criteria of the assessment (Cajander et al., 2011). This raises a number of questions in assessing those skills, not only questions of what is the right way and the right time but also where is the right place.

Furthermore, because the nature of the assessments in both case studies is too flexible and limited knowledge of generic skills attributes fail the assessment objectives. This is the result when each of the institutions and universities giving freedom to staff to impart these skills in the manner they see fit(Ministry of Higher Education, 2012). The lack of a standardised implementation and assessment of generic skills in Malaysian HE is a factor that contributes to the recurring unemployability trend (Singh et al., 2014).

Surprisingly, this study has evidenced that a few of the academic staff do not assess these skills at all, although it is stated as necessary in the ILOs. This is perhaps associated with fact that, although academic staff come from different industrial backgrounds and face different circumstances, they are also constrained by similar constraints of time, knowledge, resources and workload. It is not surprising that academic staff, who may be extremely competent in teaching their discipline, are less comfortable and less confident with learning in the workplace or vice versa (Walsh, 2006).

Reflection 3 – The role of academic staff in AL

The Malaysian education system takes a content-driven approach to teaching and learning, as discussed in Chapter 2, the academic staff transcripts show evidence that they educate their students in the same way they were educated and have experienced in the past. Subject content is the prime concern, as pointed out by almost all the academic staff. However, knowledge alone cannot compensate for competence (Weinert, 1999). As educators, academic staff need to ask themselves who they are producing knowledge for and what will be done with that knowledge (Conlon, 2008). Glover et al. (2002) recognised that effective teaching needs to consider different approaches according to maturity, discipline and objectives of the course.

Although in AL, students are required to be responsible for their own learning, the findings seem clear that academic staff contribute ways to ease the facilitation of students' engagement. Trowler (2010) in her paper highlighted the importance of the education institution, especially the role academic staff play in student engagement. Among suggestions are staff: making themselves available for consultations outside class time (Weinert, 1999); establishing concrete links with what the students has learnt and discussed with other aspects of their lives (Markwell, 2007); interacting with students and encouraging the feeling of belonging to a learning community, and the university or college as an institution (Coates, 2005, p. 6). With regards to teamwork skills, by structuring the teams accordingly, the academic staff should be able to overcome student resistance to co-operation (Koppenhaver et al., 2003).

Reflection 4 – Lack of awareness of GS expectations

Obviously, findings from the students and academic staff lead the researcher to consider the big gap between these two stakeholders regarding generic skills development and assessment practice. For instance, although learning outcome of the generic skills is acknowledged before learning takes place, most of the students report that they are not aware of the expectations with regards to developing the skills. The students report that generic skills are generally described by academic staff and none of them are certain which attributes represent the skills. The students need a clear indication of learning expectations and ways to achieve the ILOs (Walsh, 2006). This issue is verified by comments from academic staff as well. They are struggling to give a clear definition of the skills and to define criteria of the assessment. Biggs (2003a) recommended the subject matter expert to identify the appropriate verbs which represent the generic skills attributes to be more measurable during assessment.

It is also evidenced that there are academic staff who purposely do not inform the students of the assessment criteria which he/she describes as a fair assessment. These issues are confirmed by students' comments as well. The researcher concludes that, because of the academic staff's uncertainty, the students generally are not aware of the assessment criteria and not convinced by the attributes that represent the generic skills.

Reflection 5 – Students' assumptions of the intended GS attributes

In reflecting on academic practice, it becomes clear that staff expectations and practices in generic skills development and assessment are not accurately delivered to the students. For that reason, students make their own assumptions regarding the way academic staff assess the skills and the way the skills should be developed. These then become the thoughts that the students have regarding the intended attributes to be developed during their learning in HE. These misunderstandings can be avoided if academic staff brief students regarding the expectations of the attributes representing the skills early on in Higher Education. Perhaps, allowing students to recognise the intended attributes would benefit them to be more prepared and would build awareness in developing generic skills. For example, according to Dörnyei (2001), it is important to have a clear purpose in communicating to promote motivation.

Since the assessment criteria reported by the academic staff and students to be too general in its description, the researcher further suggests that clearer definitions of the skills, assessment training and guidelines would increase students' confidence in practising skills development and assessment. Clayton et al. (2003) recommended that, before assessments can be done, it is important for academic staff to inform the students: what they need to know, what they must do and the types of activities they might have to conduct to demonstrate the skills' acquisition. These are the questions which should be considered, because assessments have an important influence on the students' learning (Struyven et al., 2005) and graduates' attributes (Hughes et al., 2010).

Reflection 6 – Generic skills development vs its assessment

With regards to the generic skills development in AL environments, the students report that there are many activities designed by the academic staff to develop generic skills. Table 6-2 and Table 6-7 proved a valuable experience from students and academic staff, as they could see how it relates to their disciplines and is a hands-on experience of what they are teaching and learning themselves. Generic skills should be developed through a progressive structure throughout the engineering programme (Duffy et al., 2010) and academic staff must be aware, not only of what is being taught but also how it is being taught (May et al., 2011). This is because, over time, students should become progressively more effective, so the graduate that emerges at the end can help to reshape community and environment.

Reflecting on generic skills assessment, the researcher concludes that only some of the activities are considered during the assessment. Both the academic staff and students give much the same statements on the issue. In general, problem- solving, verbal communication and teamwork skills are mostly assessed, only during presentations, question and answer sessions, and project demonstrations as described by both case studies. The researcher finds that it is important to integrate such reflections when designing learning and teaching activities. The objective is to motivate the learner to learn and develop the knowledge and skills as the academic staff intends (Biggs, 2003b).

Reflection 7 – Outcome assessment based on academic staff's observations

Academic staff claim that they assess generic skills by focusing on the product rather than the progress in developing those skills owing to the limitations of time. For the same reason, the assessments take place, solely depending on academic staff's observations as to whether or not their student has achieved the intended knowledge and skills; no other approach is employed. Perhaps, it is wise to consider other approaches, such as logbooks or reflective report writing, as alternative methods for the students to reflect on their learning. A knowledge of reflective report writing should be provided to students, in which a reflective model is used, such as "What?", "So what?" and "Now what?" (Duffy et al., 2010).

Another approach which could be considered is to include peer-assessments. Bell (2010) recommended, to assess students' performance, academic staff should consider critical aspects, including self-evaluation and reflection from peers. These evaluations have not been employed in these case studies. However, generic skills assessments within AL environments require much care and consideration. According to Clayton et al. (2003), in order to validate the quality of the assessment, factors of invalid judgements by peers and lecturers are important to be aware of when designing the assessment.

Measuring students' generic skills is subjective as it depends only on the assessors' perceptions and observations (Yusoff et al., 2012). It is also reported by the academic staff that there are no mechanisms to monitor students' progress when developing their skills. The difficulty and complexity of assessment is to track the students' progress in programmes that permit diverse elective choices (Hager et al., 2006). For it to be effective assessment should be formative and frequent and should be simple to understand (Duffy et al., 2010). Yusoff et al., (2012) argued that measuring a student's skills and abilities to apply knowledge is ambiguous situations.

Reflection 8 – HE is responsible for preparing work ready graduates

In considering graduates' employment, employers require graduates to be work ready without additional training (Rahman et al., 2011). Lack of funds and time mean that employers rarely conduct further generic skills training especially for new graduates. Similarly, in order to minimise the probability of engineers making mistakes, employers demand HE to fully train the students with the intended generic skills. Male (2010) agreed and put forward the view that it is the engineering educators' responsibility to prepare graduates for engineering work and careers. Table 6-11 and Table 6-12 briefly discusses the employers' challenges and expectations for graduates' generic skills. The employers' requirements should be updated by HE as it evolves along with the technology (Webb et al., 2006; Selvadurai et al., 2012).

Reflection 9 – Generic skills and technical skills are equally important

When recruiting potential engineers, the requirements are for academic and technical knowledge, and also generic skills. Technical and generic skills are equally important as claimed by the majority of the employers in both case studies. These findings are also supported in many Engineering Education literatures (Yusoff et al., 2012; Abdulwahed et al., 2013; Saad et al., 2013).

The employers for both case studies inform the researcher that they have established businesses not only in Malaysia, but have also expanded their businesses to neighbouring countries. They further brief that international engineering projects and collaborations are now common with most companies. Consequently, being able to communicate with the locals adds an advantage to the personnel in establishing relationships and working efficiently with customers. Similarly, the ability to solve engineering problems within the duration and allocated funds, and the ability to work with multi-disciplinary personnel are the other preference skills among employers. However, the generic skills performance of engineering graduates has become a major concern for engineering-related employers (Puteh et al., 2013). They are evaluated not only on their outcomes but also on their collaborative, negotiating, planning, and organisational skills (Stephanie Bell, 2010). Due to these reasons, the employers react by being more demanding and becoming more selective in recruiting those who have the determination and really want to work for them.

Reflection 10 – HE institutions' collaboration with industry

The employers in these case studies suggest that the HE institutions should establish constant engagement with industry to improve the quality of their "products". They are willing to contribute ideas, provide support and co-operate with HE in order to update their demands. One of the employers, CS1E5, suggested that learning must grow synchronously as the technology changes for the better.

> *"Globalisation on the technological change is very fast, every 3-6 months; whatever you learnt from the text-book 6 months ago is different now; continuous learning processes grow as the technology changes" CS1E5 (37, Technical Manager)*

Palmer et al. (2011) suggested involving industry within the curriculum so as to recognise the expectations for contextual competence that employers want for their new hires. Similarly, Yusoff et al. (2012) recommended for HE providers, employers and government to have a common understanding, particularly regarding a set of generic skills to be cultivated for engineering students.

Reflection 11 – Academic achievement does not reflect GS

It can be said that having the required generic skills enhances the graduates chances of being employed when competing in the job market (Saad et al., 2013). The findings show that the employers valued generic skills very much and seek information on these achievements from the graduates (Knight et al., 2007).

However, good achievements in academics are no longer acceptable to employers as they claim academic results do not reflect the students' quality and performance at all. They are satisfied with the disciplinary understanding and skills developed by HE but are less happy with the development of generic skills (Yorke, 2006). CS2E3 is among the employers dissatisfied with the graduates' performance.

> *"My experience when interviewing the graduates is that I am impressed with the academic results that they have achieved. Some scored second class upper and there are also graduates who get first class honours. I can say all the students are not good with their communication skills. When we ask them to perform some work, they do not manage to do it. It is sad to see this happen." CS2E3 (41, Technical Manager)*

These accusations were also supported by other academic staff's statements as well. They have perceptions of HE, which they believe that graduates' achievements reflect the HE institution's reputation, and so giving students poor results would have a negative effect. Findings from academic staff also reveal factors like sympathy and high tolerance come into play, when assessing skills. Unfortunately, dishonest assessments, in the end, give false information to the future employer.

Another factor contributing to this issue is probably that most of the Malaysian graduates are educated to be exam-oriented. Graduates who memorise facts and figures to excel exams before attending HE may fail to develop an inquisitive mind and analytical skills (Shakir, 2009). It is apparent that many of these graduates are extrinsically motivated and engaged in gaining qualifications, rather than maximising their knowledge and skills. The undergraduates who graduate from this schooling system are identified as lacking the ingredients to develop content and generic skills (Mohd-Yusof et al., 2004; Salleh et al., 2007). The nature of education is believed to have partly contributed to the production of dependent graduates. Formal education increases an individual's formal and/or actual competence and has a central role in defining and shaping one's employability (Baker, 2009; Nilsson, 2010).

The employers' frustration of graduates' generic skills performance reported not only within this research but also in many studies from around the world (Blom et al., 2011; Mason et al., 2011; Saad et al., 2013).

7.3 Summary

The research shows the contrasting perceptions of HE (students and academic staff) with industry expectations (employers) regarding generic skills. It is clearly indicated that there are mismatched expectations among the stakeholders, and the way generic skills are being developed in HE does not map with the employers' requirements. The findings and analysis show that each of the stakeholders have a different understanding of the generic skills attributes that should be acquired by graduates before they can work in industry. These misunderstandings may lead to unfair assessments, new graduates finding it difficult to get jobs and, ultimately, affects the employers' recognition and trust of graduates' achievements. Agus et al. (2011) reported that the main reasons for unemployability are strongly related to the lack of generic skills, which perhaps correlates to some form of dissonance between employers' expectations and what the HE are offering to the students.

It is argued here that HE needs to widen its focus in generic skills development, if students are to be educated as competent engineers. Students are expected to acquire the intended generic skills as needed by employers in order to be more marketable in industry. How can this be done? As this chapter shows, although there is some evidence of generic skills assessment within active learning environments in the literature, there is a need for more structured interventions. The data gathered in this research can be used as a basis to improve the assessment approaches within active learning environments, whilst aligning with designated learning outcomes. In doing so, Engineering Education standards can be promoted, whilst meeting industry requirements.

8 Conclusions

8.1 Introduction

This research addressed the processes involved in the generic skills assessments in Malaysian HE. The study also presents the students' and academic staff's perceptions of generic skills assessments. The research specifically focused on the engineering discipline (Mechatronics Engineering and Bio-Medical Electronics Engineering) within AL environment (PBL and WBL). The employers' reflections on the generic skills attributes that engineering graduates should possess have also been investigated.

The review of the relevant literature showed there has been little research on assessing generic skills in engineering programmes within AL environments. This research was an attempt to fill this gap.

The conclusions drawn in this chapter are based on the assessments carried out in all the previous chapters and from the evidence which emerged from the case studies. The aim of the following section is to complete this work by addressing the limitations of the study, and highlight its contribution to knowledge, practice and theory. The chapter continues with notes for practitioners and recommendations for further work.

8.2 Novel Findings and Contribution to Knowledge, Practice and Theory

The first objective of this study was to critique the existing methods of assessing generic skills in the context of Engineering Education within an AL environment based on the literature. This research addressed important issues that contribute to knowledge. The main aim of the research was to investigate generic skills assessment within an active learning environment in the Higher Education sectors of Malaysia. To achieve this aim, a comprehensive literature review was carried out, followed by exploratory research, methodology and two case studies with selected Malaysian HE institutions.

In the early stage of the research, the research design proposed conducting an exploratory research to enable the researcher to achieve in-depth understanding of the research areas. In the main study, qualitative research was conducted, employing semi-structured interviews with 14 academic staff, 16 students and ten employers in two HE institutions which implement an AL approach. The research used participant and data triangulation via semi-structured interviews and course documents. The use of case studies was to investigate the implementation of AL and generic skills (focused on problem-solving, verbal communication skills and teamwork) assessment in more than a single case in different AL environments.

The research assessed the academic staff and students' perceptions of generic skills assessment. Also, it determined the employers' requirements for generic skills attributes that graduates should possess after studying at HE institutions. The results of the cross-case study were analysed using thematic analysis and displayed in tables in Chapter 6, to provide a rich representation of the research phenomenon for the case institutions. Moreover, the study described the activities that were involved in developing generic skills and their attributes during the assessment process.

This study has contributed significantly to:

a. Knowledge

- Contributed new knowledge on the assessment of engineering students' generic skills (problem solving, verbal communication and team work) within the AL environment.
- Used a novel approach that integrates the perceptions of academic staff, students and employers.

b. Practice

- The output of this study is the framework and curriculum matrix for assessing generic skills in Engineering Education concerning its attributes as shown in Figure 8-1 and Table 8-1. Figure 8-1 demonstrates the practice of HE in developing and assessing generic skills, especially for Engineering Education students/graduates. The solid red box represents the process involved in inculcating students' generic skills. When students come into HE, with regards to any subjects, they are informed of the intended learning outcomes, presented with the expectations or standards from the HE institution and professional organisation body respectively. The students are then expected to develop their generic skills, either in class or in a working environment, with guidance from the lecturers/mentors. Then, the lecturers/mentors observe and assess whether the students demonstrate the intended attributes. Details of the assessment attributes are shown in Table 8-1. The precise attributes chosen indicate the type of activities the students need to perform and the level of sophistication which they must demonstrate (Biggs, 1987, 2003a; Walsh, 2006). The bottom part of the dotted red box is the internal reflection on the students' generic skills performance after completing the HE programme.

  The blue box outside the red dotted line is external feedback to the HE containing the employers' updates on generic skills requirements, current graduates' performance and labour market demands. Employers are the “buyers” who seek value for their money and it is the responsibility of the HE to produce “products” that meet the expectations and demands of “customers” (the employment market) (Agus et al., 2011, p. 317). In that respect, as they are the “end users”, it is fair to say that employers have the responsibility to set the skill standards for the graduates which they should acquire before they can enter industry.

After reflection of either internal or external feedback, the framework shows that harmonisation is required in order to synchronise students' performances with the demands of industry. Harmonisation is important to create a consensus regarding the generic skills attributes and whether the intended learning outcome, learning activities and assessment need to be maintained or revised.

Adoption of the framework in Figure 8-1 could give the opportunity for students to be aware of Higher Education’s, professional bodies’ and employers’ expectations while they are still in HE. Similarly, the curriculum matrix could maintain the assessment standardisation amongst academic staff and provide measurable assessment of students’ generic skills attributes. This contribution could also provide a common generic skills assessment matrix of standards for Engineering Education not only in Malaysia but also in the global context. This contribution is aligned with the suggestion by Singh et al. (2014) to standardise the implementation and generic skills assessment in Malaysia HE institutions to increase the graduates’ potential employment in the industry.

Table 8-1 Proposed curriculum alignment matrix for generic skills assessment (Source: author)

Generic Skills	Engineering Programme Outcome (source from EAC, 2012)	Learning Activities	Assessment Tasks and Assessment Criteria					
At the end of this module, students should acquire the skills of:			**Presentation/ Demonstration**	**Question & Answer**	**Project Implementation**	**Self- and Peer Assessment**	**Discussion**	**Reflective Report**
1. Problem-solving	Ability to undertake problem identification, formulation and solution.	• Project Implementation • Discussion			• Solve problem within time and budget • Be creative • Be independent • Anticipate continuous improvement • Report progress • Objective focus	• Skills and knowledge sharing	• Identify the problem • Think, talk and decide • Prepare contingency solution • Convince • Be resourceful (know where to find info)	• Write problem-solving skills reflections
2. Verbal/Oral Communication	Ability to communicate effectively, not only with engineers but also with the community as a whole.	• Presentation/ Demonstration • Question & answer • Discussion	• Fluency, converse in English • Understand presentation contents • Aware of individual background & personality • Engage with audience	• Explain with confidence • Interact with multi- (disciplinary/ racial/level/ nationality) personnel/ students • Handle and manage situations		• Communication with other students, lecturers/ mentors and others	• Negotiate • Listen and acknowledge • Voice out • Via social network or other web applications	• Write verbal communication skills reflections
3. Teamwork	Ability to function effectively as an individual and in a group with the capacity to be a leader as well as an effective team member	• Presentation • Project Implementation • Discussion • Question & Answer	• Active participation • Supportive • Constructive feedback		• Tolerate • Co-operate • Delegate tasks • Be aware of own and others' tasks • Give and obey instructions • Work with cultural diversity	• Fairness • Satisfaction	• Comfortable with disagreement • Update on individual tasks • Share ideas	• Write teamwork skills reflections

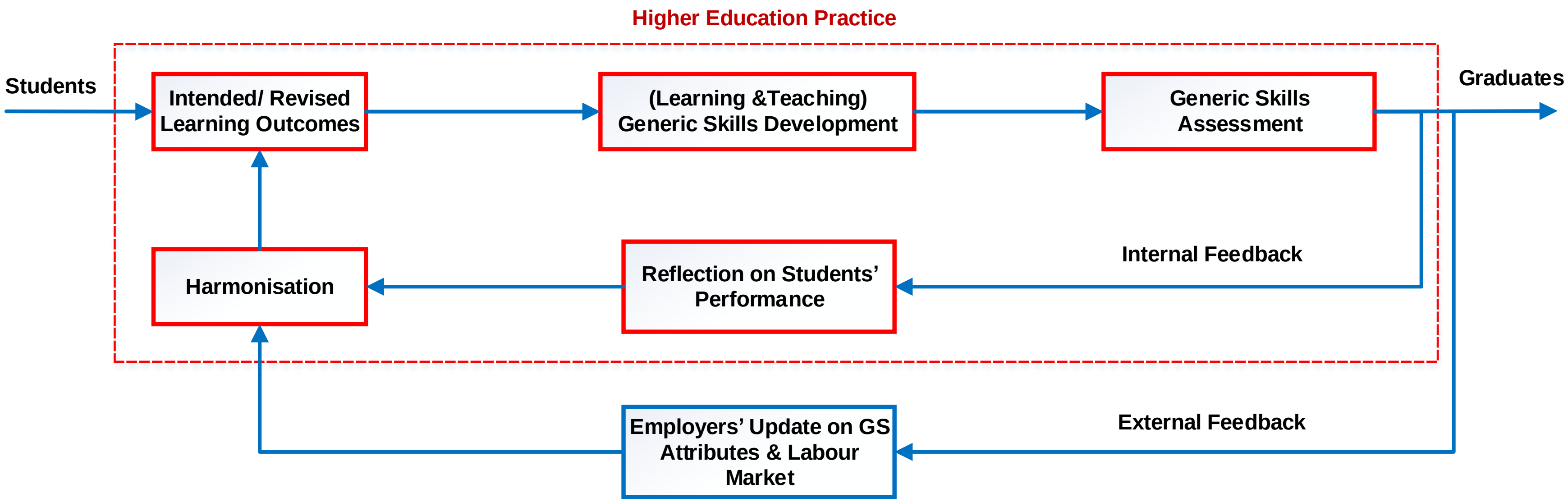

Figure 8-1 Proposed generic skills assessment framework (Source: author)

c. Theoretical

By integrating Constructive Alignment theory (the active learning and teaching approach, learning outcomes, and assessments) and Consensus theory of employability (Higher Education, employment, and the labour market) in the conceptual framework presented in Chapter 3, the study extended the theory in the area of generic skills assessment and learning. Constructive alignment ensures the teaching methods used and the assessment tasks, are aligned to the learning activities assumed in the intended outcomes. Consensus Theory in employability believes, by instilling generic skills at tertiary level, the employability of graduates is endured. The relations between both theories as such, feedback from the employer and labour market to Higher Education institutions on generic skills development might impact the fundamental changes to be made by aligning active learning and teaching approaches, intended learning outcomes and methods to assess the skills in a more measurable way.

8.3 Limitation of this Study

The scope of this study is limited to engineering students who enrolled in two Malaysian HE institutions which implemented AL as the students learning approach. Other limitations are described as below:

- **Generic skills limitations:** The scope of the study was based on the objective to revise the assessment of generic skills: namely, problem-solving, communication skills (oral/verbal) and teamwork only. The justifications of the three generic skills were presented in Chapter 1.4.1, after considering accreditation requirements and employers' demands.
- **Professional limitations:** The studies only focused on Engineering Education institutions which implement a fully AL approach in its programme. Justification of the selection discipline and programmes has been discussed in Chapter 3.4.4.
- **Methodological limitations:** The research adopted multiple case study approach; therefore, it has limitations in the methodological sense. They are briefly summarised as:
    a. Being a qualitative-based study means that impressions and interpretations cannot be statistically tested.
    b. The research has depended extensively on semi-structured interviews. Two major risks commonly associated with this approach are the veracity of the people interviewed and errors of memory.

c. External validity: whether the outcomes have any greater significance beyond the immediate context, and whether they can be generalised across different settings.
d. Reliability: it is believed that qualitative research does not provide as high a reliability as quantitative research.

- **Practical (data collection/scheduling) limitations:** As the study was conducted in Malaysia, it is acknowledged that the research was limited to the academic semester or term per year as shown in Table 8-2.

Table 8-2 Academic semester/term per year and intakes (Source: author)

Institution/University	Semester/Term
Case Study 1	January – June (1st Semester) July – December (2nd Semester) **Note: Intake for both semesters**
Case Study 2	December – April (1st Semester) June – November (2nd Semester) **Note: Intake for both semesters**

- **Geographical limitations:** The case studies only conducted in institutions which are located in one of the states in Central region of Malaysia, Selangor. Justification of the selection institution has been discussed in Chapter 3.4.4.

Despite all the limitations listed above, the study provides a rich and contextualised understanding of the research phenomenon.

8.4 Notes for Practitioners

Table 8-1 presents criterion located in its dedicated assessment task which fits with the research. However, in using this framework, the practitioner could choose different assessment task; and he/she could consider moving the criteria around. If they feel from their work the assessment criteria that the researcher has identified is a complete set of criteria; the practitioner could shuffle the assessment tasks into different boxes, if preferred. The practitioner could move the assessment criteria around, which could provide flexibility when using the framework.

However, please bear in mind, the first three columns are going to stay the same, and six of the assessment tasks will remain the same. The practitioner can only reshuffle the criteria. It is advisable not to change the name of the criteria, just move from one box to another. Table 8-3 is an example of an alternative generic skills assessment framework. The red highlighted words are changes made on purpose to show that the framework can be modified to suit the practitioner's approach. The framework design is not fixed. It offers the kind of flexibility that the researcher proposed earlier.

Table 8-3 Alternative curriculum alignment matrix for generic skills assessment (Source: author)

Generic Skills	Engineering Programme Outcome (source from EAC, 2012)	Learning Activities	Assessment Tasks and Assessment Criteria					
At the end of this module, students should acquire the skills of:			**Presentation/ Demonstration**	**Question & Answer**	**Project Implementation**	**Informal Peer Assessment**	**Discussion**	**Reflective Report**
1. Problem-Solving	Ability to undertake problem identification, formulation and solution.	• Question & answer • Project Implementation • Discussion		• Interaction with multi-(disciplinary /racial/level/ nationality) personnel	• Solve problem within time and budget • Be creative • Be independent • Anticipate continuous improvement • Work with cultural diversity	• Skills and knowledge sharing	• Identify the problem • Think, talk and decide • Prepare contingency solution • Handle and manage situations • Objective focus	• Write problem-solving skills reflections
2. Verbal/Oral Communication	Ability to communicate effectively, not only with engineers but also with the community as a whole.	• Presentation/ Demonstration • Question & answer • Project Implementation • Discussion	• Fluency converse in English • Understand presentation contents • Engage with audience	• Explain with confidence • Convince • Be resourceful (know where to find info)	• Report progress	• Communication with other students, lecturers/mentors and others	• Negotiate • Voice out • Via social network or other web applications • Aware of individual background & personality	• Write verbal communication skills reflections
3. Teamwork	Ability to function effectively as an individual and in a group with the capacity to be a leader as well as an effective team member	• Presentation • Project Implementation • Discussion	• Active participation • Supportive • Constructive feedback		• Tolerate • Co-operate • Delegate tasks • Be aware of own and others' tasks • Give and obey instructions	• Fairness • Satisfaction	• Comfortable with disagreement • Update on individual tasks • Share ideas • Listen and acknowledge	• Write teamwork skills reflections

Table 8-3 outlines an alternative generic skills assessment framework, which consists of the intended generic skills, engineering programme outcome, learning activities and assessment tasks and assessment criteria. The first column of the framework identifies the generic skills which are deemed essential to be possessed by the students, which are problem-solving, verbal/oral communication and teamwork. The engineering programme outcome refer to those provided by the Malaysian Engineering Accreditation Council (EAC, 2012) and are listed in the second column of the framework. These are the intended outcome to be possessed by the students by the end of HE. The third column in the framework presents the learning activities involved to develop the skills. The assessment tasks are divided into six groups, namely: presentation/demonstration, question and answer, project implementation, informal peer-assessment, discussion and reflective report. Below the assessment tasks are the recommended assessment criteria that should be considered by the practitioner when assessing generic skills.

8.5 Future Work

1. In determining whether the assessment criteria are met, there is a layer of details underneath, which is about specifying how skills and knowledge sharing is identified (through assessment in a rubric). The researcher identifies the assessment task and their criteria clearly in each institution/programme/module/context, and the practitioner will then need to determine a satisfactory rubric to demonstrate that those tasks happened and such criteria are achieved by the students. Bell (2010) strongly claimed that most of the generic skills are not measurable through standardised tests (p. 43). She further recommended the use of rubrics to assess students' performance after considering the critical aspects. This will make the assessment more measurable.
2. It is suggested to conduct further quantitative research in large-scale cross-institutional and cross-country studies to provide empirical findings to affirm/reject the proposed generic skills framework.
3. Currently, the investigation of both case studies only involved three groups of participants (academic staff, students and employers). The researcher suggests involving policy makers, such as higher personnel from standard accreditation organisations and from the Ministry of HE. If they were involved, the research could provide new information from the policy makers' perspectives, for example whether or not it is feasible to implement the framework at the national level.
4. The research only focused on three generic skills, probably in future the research could expand in other generic skill areas, such as lifelong learning, critical thinking and, ethics and professional morals, which are also considered important in the literature.
5. Similarly, more research could be developed involving other AL approaches such as

Project-Based Learning, CDIO, POPBL and others (as described in Chapter 2.6). If this is achieved, the researcher can enhance the validity and reliability of the research and perhaps offer a contrast in situations, probably in the standards, culture and habits reflecting institutional domains.

8.6 Conclusions

This chapter presents a summary of the outcomes or conclusions from this research, in the form of the contribution to knowledge, practice and theory, limitations of this study, notes to the practitioner, and recommendations for future work.

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Appendices

Appendix 1 – IRSPBL Paper

The 4th International Research Symposium on Problem-Based Learning (IRSPBL) 2013

How effective is the assessment of generic skills gained by Technical Vocational Education and Training (TVET) of engineering students engaged in Problem-Based Learning (PBL)? – A Literature Review

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Abstract

The review of the literature for this study focusses on PBL approach within the Technical Vocational Education and Training (TVET) of engineering, and the development of assessment on engineering students' generic skills. Key findings of the research point to four aspects: inter engineering disciplines; different cultures; different education policies; and world globalisation with rapid technology changes; will be considered during designing the assessment. The identification and the development of measurable and reliable method for assessing the engineering students' generic skills through PBL approach are crucial to the overall success of the respective Technical Vocational Education and Training (TVET) institution.

Keywords: Generic skills, problem-based learning, assessment, technical vocational education and training (TVET), engineering;

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1. Introduction

Graduates from higher education who grasps generic skills competencies during studies have added value in their career development. With the dramatic changes in technology, graduates should be able to digest, apply and distribute information with precision and ease. Young et al. (2010) commented in their research, employers who operate in global markets now seek employees who possess not only high-level technical or 'job-specific' competencies, but also, high levels of communication skills, problem-solving and conflict resolution (p. 1).

The generic skills in this research refer to the problem-solving, critical thinking, communication and lifelong learning skills of graduates. Therefore, this paper aims to critically assess the effectiveness in terms of reliability, measurability and validity of the assessment methods of generic skills through PBL approach amongst Technical Vocational Education and Training (TVET) engineering students. To achieve the above aim, the paper begins by looking at the terminology of generic skills in different countries and the importance of generic skills at the workplace. The paper thus discusses the approaches used in the generic skills development especially in Technical Vocational Education and Training (TVET) perspective. The next part of the paper focuses on the generic skills assessment methods through PBL approach and the problems faced in verifying the assessment in PBL.

The paper concludes that the aspects in inter Technical Vocational Education and Training (TVET) disciplines, different cultures, different education system policies, and globalisation alongside rapid technology changes will be given due consideration when designing the generic skills assessment. This research will contribute a positive impact on PBL assessment especially in Technical Vocational

Education and Training (TVET) engineering students' generic skills achievement in a measurable context. Indirectly, it may also be deemed as a performance indicator of the Technical Vocational Education and Training (TVET) institution and Ministry of Higher Education respectively. This would be the focus of this research as emphasised in the research question and objectives.

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2. Background – Context: Generic Skills in Technical Vocational and Education Training (TVET)

Generic skills are the skills that students need to become more successful learners and successful practitioners in their field of study, work and other aspects of their life are an important outcome of university education (Bennett et al., 1999; Biggs, 1999a; Allan et al., 2007). The terminology used to refer to generic skills differs from one country to another. (NCVER, 2003). The terms include: 'key competencies', 'soft skills', or 'employability skills' (Australia); 'key skills' or 'core skills' (United Kingdom); 'essential skills' (New Zealand); and 'necessary skills', 'employability skills' or 'workplace know-how (United States). Essentially, the terms refer to the same skills as shown in Table 1.

Though an academic qualification is the more important criterion that an employer looks for, what differentiate graduates from other graduates are their interpersonal skills, communication skills, critical thinking and problem-solving skills. Hamzah et al. (2009) suggested that any organization's portfolio should include the generic requirement for each job so that the prospective employees can make necessary steps to equip themselves for the job and know their competency level (p. 688). Lack of these skills will effect on job opportunities as reported in The Chronicle of Higher Education on 5th December 2011, employers say college graduates lack of job skills and this is supported by Mail Online, London, England reported on 26th January 2012, that one in three top companies can't fill graduate vacancies: Too many leave universities without the right skills, say bosses. While "Too many young people lack the social skills needed to get their first job" the statement appeared in the BBC News Education and Family on the 23rd May 2012. Jideani et al. (2012) stated "academic success is not in terms of what students can remember, but in terms of what students are able to do with their knowledge" (p. 34) which is also referring to the lifelong learning capabilities.

Globalisation and rapid changes in technology imply the need for workforces that not only have specialist knowledge and skills, but have developed the generic skills needed to adapt quickly to new emerging technologies (UNESCO, 2012). With respect to that circumstance, the education in the 21st century has had a considerable impact on learning and teaching approach adopted in further and higher education especially in the Technical Vocational and Education Training (TVET) engineering discipline. Typically, most of the technical and vocational subjects are still delivered using traditional of four step method training of Allen (1919) approach which starts with describe, demonstrate, try-out by trainee and evaluate with feedback. However, students trained via Allen (1919) approach are lack with the required generic skills by the employer such as problem-solving, critical thinking, communication and lifelong learning. Though generic skills are important for the graduates during the job hunting, it is also a need for them to acquire technical skills through hands-on experience that will enable them to solve problems which emulate industrial problems. Instead of spoon-feeding students with fundamental theories and ideas, Problem-Based Learning (PBL) is one of the active learning approaches that have been introduced as an alternative and integrated way in Technical Vocational Education and Training (TVET) learning and teaching (Mohd Faiz et al., 2008; Masek et al., 2010b).

Technical Vocational Education and Training (TVET) have been known as an education and training system to produce highly skilled workforce and knowledgeable manpower particularly in modern careers. Political and economic leaders around the world acknowledge that the workforce skill level is what determines the economic performance (Benjamin, Klein, et al., 2012). Consequently we witness the development of many vocational and technical training institutions and universities in the effort to fulfill these needs in developing or developed countries (Tabbron et al., 1997). Adopting PBL in engineering teaching approached have significantly improved the students' personalities and attitudes

(Prince, 2004). Instead of curriculum development, learning outcomes and policies, assessment is the main criteria to measure the quality of the engineering students and Technical Vocational Education and Training (TVET) institutions. Currently, the assessment on the academics is very objective and well structured, which leaves the generic skills assessment to be subjective and immeasurable. A valid, measurable and up-to-date assessment method will be designed in order to measure the effectiveness of the Technical Vocational Education and Training (TVET) engineering students' generic skills: problem-solving; critical thinking; communication; and lifelong learning; and to assure the quality of Technical Vocational Education and Training (TVET) institution respectively.

3. Discussion: Components of PBL – Brief Overview of Different Learning Approach

3.1. Active Learning

Active learning is contrasted to the traditional way of learning where students passively receive information from the instructor. It is generally defined as any instructional method that engages students in the learning process (Prince, 2004). Drake (2012) agreed with Prince but added that the students need to be responsible for their own learning. While Felder et al. (2009) defined active learning as "anything course-related that all students in a class session are called upon to do other than simply watching, listening and taking notes" (p. 2). The most commonly cited definition of active learning comes from Bonwell et al. (1991) "Involving students in doing things and thinking about what they are doing" (p. 2). And we may have heard - "Tell me and I forget. Show me and I may remember. Involve me and I will understand" (Confucius, c.500BC). Though it is just a simple statement, it makes complete sense from the learning and teaching perspectives.

Different methods of active learning that most frequently discussed in the engineering literature are collaborative learning, cooperative learning, Conceive-Design-Implement-Operate (CDIO), Experiential Learning Theory (ELT) and Problem-Based Learning (PBL). Collaborative learning may refer to any instructional method in which the students at various performance level work together in small groups towards a common goal (Gokhale, 1995). As such collaborative learning can be viewed as encompassing all group-based instructional methods, including cooperative learning (Prince, 2004). Prince also added, some authors distinguish collaborative and cooperative learning as the collaborative learning is the emphasis on students' interaction rather than on learning as a solitary activity.

Cooperative learning is defined as a structured form of group work where students pursue common goals while being assessed individually (Panitz, 1996; Prince, 2004). Unlike less structured forms of collaborative learning, cooperative learning requires students to be individually responsible for their own learning. Therefore the teacher or facilitator need to carefully design the learning activities and regularly monitored as Smith et al. (2005) quoted "engaging students in learning is principally the responsibility of the teacher" (p. 2).

Another method of active learning is the CDIO. In the late 1990s, CDIO concept was originally conceived at the Massachusetts Institute of Technology. CDIO provides the students with engineering fundamentals set in context of conceiving – designing – implementing – operating industrial systems, industrial equipment and products (Crawley et al., 2007). Crawley et al. (2007) listed three overall goals for CDIO, which are the students, should be able to:

- Master a deeper working knowledge of technical fundamentals.
- Lead in the creation and operation of new products, processes, and systems.
- Understand the importance and strategic impact of research and technological development in the society (p. 2).

Experiential Learning Theory (ELT) has been introduced and widely used in human learning and development. The theory is called "experiential" is its intellectual origins in the experiential works of Dewey, Lewin, and Piaget. Taken together, Dewey's philosophical pragmatism, Lewin's social psychology, and Piaget's cognitive-developmental genetic epistemology form a unique perspective on learning and development (Kolb, 1984; Kolb et al., 2001).

Problem-Based Learning (PBL)

PBL approach is common in medical institutions. The approach was also largely conceived and developed in the academy, initially for training lawyers and clinical practitioners and subsequently adopted for other professional courses (Savin-Baden, 2000). Nevertheless, it is just as appropriate for technical vocational subjects, including family and consumer sciences, and traditional academic subjects (Ward et al., 2002). The rationale behind the statement is, in Technical Vocational Education and Training (TVET) the students need to master the hands-on skills and not so much on critical thinking skills as training lawyers and clinical practitioners. Therefore, there will be a difference of PBL implementation and assessment approach in Technical Vocational Education and Training **(**TVET) as compared to medical where PBL originated.

PBL is an innovative approach to learning that teaches a multitude of strategies critical for success in the twenty-first century (Bell, 2010). She also added through the problems, students gain knowledge from group discussions and asking questions that have piqued their natural curiosity to learn (p. 39). Savin-Baden (2000) defined PBL as an approach to learn through which many 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). In PBL, teachers act as facilitators, moderators or advisors (Ward et al., 2002) to oversee each step of the process, give feedback and approve each choice before student embarks on a direction (Savin-Baden, 2000). This will help the students to develop self-reliance and lifelong learning in them.

The main goals of PBL are to help the students develop their generics skills such as flexible knowledge, effective problem-solving skills, self-directed learning, effective collaboration skills and intrinsic motivation (Tchudi et al., 1996; Hmelo-Silver, 2004). In PBL environment, the contents are transformed into ill-structured problems to provide more realistic approach to learning and to create an educational methodology which emphasises real world challenges, higher order thinking skills, multi-disciplinary learning, independent learning, teamwork and communication skills which motivate students to prolong lifelong learning (Paul, 2010).

Boud et al. (1998) considered PBL as one of the most influential of the last decades and defined it as a carefully planned curriculum, which is entirely based on solving practical problems and practical cases. According to Meier et al. (1996), students taught within the lecture-based disciplinary system typically have not been able to solve problems that require them to make connections and use relationship between concept and content. While in interdisciplinary teaching, it starts with a topic, theme, problem, or project that requires active student engagement and knowledge of multi-disciplines in order to reach the learning outcome. In PBL (Savin-Baden, 2000) concerned that, the focus in organizing the curricular content is around problem scenarios rather than subjects or disciplines (p. 3). Because PBL is often interdisciplinary in nature, teacher need to recognize the connections between discipline and collaborate with other teachers in developing learning experiences that provide relevant application of contents and skills (Meier et al., 1996; Ward et al., 2002)

However, Prince (2004) argued, based on the literature, faculty adopting PBL are unlikely to see improvement in student test scores, but are likely to positively influence student on attitudes and habits in learning independently. This is the strength in PBL. The learning uses relevant applications that motivate students to search for a need of facts and not being dependent on the teacher. Masek et al. (2010b) described PBL as one of the methods which resulted to Student Centred Learning (SCL) (p. 10). This method encourages students to solve relevant problems within groups and classes using the prior knowledge and available resources.

Prince (2004) suggested that the engineering faculty should be strongly encouraged to look at the literature on active learning because some of the evidence for active learning is compelling and should stimulate faculty to think about teaching and learning in non-traditional ways (p. 3). Ozbicakci et al. (2012) concerned in order to create a student-centred approach through PBL also requires faculty to give up traditional ways of instruction and places the responsibility for learning squarely on student (p. 79).

3.2. Assessment in PBL

The essential feature of a teaching system designed to emulate professional practice is that the crucial assessments should be performance-based, holistic, allowing plenty of scope for students to make their own decisions and solutions (Biggs, 1999a). Generic skills assessment in engineering is a major challenge in PBL (Nopiah et al., 2009). Prince (2004) added skills in problem-solving and lifelong learning are difficult to measure which resulted in data are less frequently available for these outcomes than for standard measure of academic achievement (p. 2).

Agreeing on what is to test and what is to focus is a matter of much debate. Assessment in PBL requires as much care and consideration as it is under other approach to learning and teaching. The consequence of this is that, if lecturers retain the assessment methods they use in their traditional curriculum approaches, the outcome can be a misalignment between their objectives and student learning outcomes (Mcdonald, 2005; Ozbicakci et al., 2012). Macdonald et al. (2004) have a set of principles to guide in assessing students in enquiry and Problem-Based Learning. In most of the guidelines highlighted, the assessment should simulate what the professional does in their practice and ideally be based on a practice context in which students will find themselves in the future (p. 6). Mcdonald (2005) agreed and added assessment should also be moved beyond factual recollection to the application of knowledge and skills towards increasingly complex situations, involving a range of intellectual and practical activities in a variety of contexts. One of the approaches to ensure and assess the alignment of assessment methods with the learning outcomes is to use Bloom's taxonomy of cognitive domains (Jideani et al., 2012). It is well-defined and broadly accepted tool for categorizing types of thinking into different levels: knowledge, comprehension, application, analysis, synthesis, and evaluation (Crowe et al., 2008).

In order to analyse perceptions of the depth of understanding that students acquire, the lecturer must not discriminate students and should assess fairly with strong justifications, in other words being objective. In some cases, reported by Bollela et al. (2009) research outcomes mentioned the reluctance of the lecturer to award high marks to the student because of student's immaturity and sincerity. Since the human perceptions and assessment is very subjective, it is also happening during the peer- and self-assessments among the students. Reflection or peer assessment and self-assessment requires students to reflect and evaluate their own participation, learning progress, and products of autonomous learning (Hart, 1994). They evaluate not only their learning, but also the success of their social interactions (Bell, 2010). Papinczak et al. (2007) mentioned in their research that performance of their peers is better compared to their own performance (p. 122). The studies have confirmed that self-assessment of process is not an accurate measure compared to their peers.

There are several methods used previously to measure student skills, performance and progress. One potential assessment has been developed by Novak (1990) was Concept Mapping (CM) at Cornell University. CM is the metacognitive tool that was developed for the study to show changes in learning. Another appropriate assessment found by Gallagher et al. (1995) using a lab notebook as the problem log to record ideas, plans, strategies and progress. It assessed the record of a students' thinking process and documented student participation. The common practice in PBL assessment is students prepare a portfolio for assessment that includes notes, commentaries and articles they have read, and discussions of the evolution of their ideas to formulate and report their findings and conclusion (Tchudi et al., 1996; Ward et al., 2002; Tai et al., 2007).

Another potential assessment is the authentic assessment and rubrics that were used in high school family and consumer nutrition class (Ward, 1998; Ward et al., 2002). Authentic assessment is utilized as students were evaluated using appropriate rubrics. Authentic assessment are categorised into performance assessment, portfolio assessment and self-assessment (Hart, 1994; Tai et al., 2007). Boden et al. (2007) also noted in their research, The Department of Aerospace at the United States Naval Academy (USNA) via CDIO syllabus have used rating scales (rubrics) for evaluating student performance in the form of journals of student reflections, portfolio of student work over time, capstone project, and during oral presentations, in-class discussions and technical reports (p. 119).

Bollela et al. (2009) concerned the major challenges when implementing PBL is the use of appropriate strategies to assess formative generic skills assessment of the students (p. 2). The existing substantial variation in the assessment of the PBL process is largely confined to formative purposes only. However, Knight (2001) notes in his research, assessment for summative purposes is viewed as being of such high stakes that those being assessed see it as being in their own interests to emphasise what they know or can do - however limited or poorly - and to cover up as much as possible what they do not know or cannot do. Upadhyay et al. (2011) recommended, in setting up the summative assessment of the PBL, the curriculum needs to be designed in an innovative way, adopting various strategies to foster such skills and behaviours and incorporating the measurement into the assessment (p. 1151).

Assessing “what works” requires looking at a broad range of learning outcomes, interpreting data carefully, quantifying the magnitude of any reported improvement and having some idea of what constitutes a “significant” improvement (Prince, 2004). No matter how data is presented, there is always the issue of interpretation, although it is helpful to look at both statistical measures. It is hard to develop questions that will measure creativity, critical thinking and generic skills. Tchudi et al. (1996); Ward et al. (2002) describe assessment in PBL as a game that engages the student in guessing what teacher wants rather than demonstrating the best they can do. They even suggested if PBL changes the game and learning is to be seen as relevant to life, new methods are needed for the teacher to be able to assess student progress.

According to Joy et al. (2009), there is an impact of culture in learning style scales and in deciding a persons’ preference for abstract conceptualization versus concrete experience. Reliability and validity of the generic skills assessment need to be designed personally based on the disciplines and cultures. If it is not to be considered, the consequences might turn out as reported in The Australian in Higher Education segment on the 16th March 2012, an interim evaluation of the Assessment of Higher Education and Learning Outcomes, or AHELO, has done the feasibility study on the US generic Collegiate Learning Assessment (CLA) test and found that it was hard to judge whether a generic skills assessment that was not linked to discipline content and different cultures, can be valid and reliable.

4. Conclusion

Based on the literature that has been reviewed, it will challenge the PBL assessment design to be more measurable and reliable especially in generic skills from Technical Vocational Education and Training (TVET) in engineering perspective. The aspects of inter disciplines, different cultures and education system policies need to be considered when designing the generic skills assessment. Globalisation and rapid changes in technology must also be taken into account. As TVET students are expected to master the hands-on skills and not so much on the critical thinking, there will be a difference in PBL implementation and method of assessment.

This research will be using an inductive approach, where it will begin with PBL assessment observation and measures. Then detect the generic skills patterns and current assessment methods to measure the skills, formulate the tentative hypothesis and finally end up developing some general conclusions or theories. Details of the research methodological will be written in the future paper.

By determining the effectiveness of the students’ generic skills, the institute/university and Ministry of Education would be able to bring about curriculum change to help the students develop better skills.

The author supports this with the claim that the development of quality, valid and reliable assessment method, and the engagement in actual assessment help to improve students and institute/university performance.

5. Tables

Table 1. Comparison of Generic Competencies

Australia	**United Kingdom (NCVQ)**	**United States (SCANS)**	**New Zealand**
Key competencies	Core skills	Workplace know-how	Essential skills
Collecting, analysing and organising information	Communication	Information Foundation skills: basic skills	Information skills
Communicating ideas and information	Communicating Personal skills: Improving own learning and performance	Resources Foundation skills: basic skills	Communication skills
Planning and organising activities	Personal skills: Improving own learning and performance	Resources Foundation skills: personal qualities	Self-management skills Work and study skills
Working with others and in teams	Personal skills: working with others	Interpersonal skills	Social skills Work and study skills
Using mathematical ideas & techniques	Numeric: application of numbers	Foundation skills: basic skills	Numeric skills
Solving problems	Problem-solving	Foundation skills: thinking	Problem-solving and decision-making skills
Using technology	Information technology	Technology Systems	Information skills Communication skills

Source: (Moy, 1999)

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Appendix 2 – Abstract for 2014 Aston University Learning and Teaching (L & T) Forum

Students' Perceptions towards Generic Skills Assessment Experiences within Active Learning Environment in Malaysia Engineering Education – The Emerging Findings

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CONTEXT

Malaysian Higher Education in the 21st century has had a considerable impact on the learning and teaching approaches adopted, particularly within the field of Engineering Education (EE). Instead of teaching students with fundamental theories and ideas, active learning has been introduced as an alternative and integrated way of learning and teaching generic skills as it promotes interaction within the classroom and allows theoretical concepts to be taught in an applied, "hands-on" way. In considering Engineering Education, academic knowledge and technical competencies are equally as important as generic skills in terms of students' overall employability. In the context of this paper, generic skills include verbal communication, problem-solving and team working. The assessment of such skills represents an important part of learning and it is this assessment which will be discussed.

PURPOSE

The aim of this paper is to critically discuss engineering students' perceptions and experiences during generic skills assessment within the active learning environment.

APPROACH

Following a case-study methodology, students' assessment approaches to three generic skills were investigated; verbal communication, problem-solving and teamwork are critiqued. A total of 8 final year students in one of Malaysia Higher Education institutions were interviewed using semi-structured interview techniques. The sample comprised of multi-racial students who are currently undergoing Mechatronics Engineering programme.

RESULTS

Overall, the students' initial feedback was generally lacking in substance as they have limited knowledge and understanding of these generic skills. Typical problems identified during the study included; such generic skills not well define, a lack of standardisation within various assessment processes and lecturers' biased in assessment practices.

CONCLUSIONS

In conclusion, the emerging findings of the interviews reinforce arguments that there is clearly much room for improvement when considering generic skills assessment. Measures need to be put into place to make such assessment both rigorous and quantifiable. In order to achieve this, one of the primary outputs from this PhD study will be an assessment framework; the aim of which will be to improve the assessment approaches whilst meeting alignment across the designated learning outcomes and in doing so can promote Higher Education standards.

KEYWORDS

Engineering education, active learning, and generic skills assessment

Appendix 3 – REES Paper

Lecturers' Experiences towards Generic Skills Assessment within Active Learning (AL) Environment in Malaysia Engineering Education – The Emerging Findings

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***Abstract**: The aim of this paper is to explore the engineering lecturers' experiences of generic skills assessment within the active learning environment in Malaysia. Pursuing a case-study methodology, lecturers' assessment approaches to three generic skills were investigated; verbal communication, problem-solving and teamwork. The assessment of such skills represents an important part of learning and it is this assessment which will be discussed. The findings show the lecturers' initial feedback was generally lacking in substance as they have limited knowledge and experience of assessing generic skills. Typical barriers identified during the study included; such generic skills not well define, inadequate alignment across the engineering curricula and teaching approaches, too flexible in assessment practices, particularly in relation to implementation; and a failure to keep up to date with industry requirements. The emerging findings of the interviews reinforce arguments that there is clearly much room for improvement when considering generic skills assessment.*

Introduction

In Malaysian Engineering Education, many engineering undergraduates experienced exam-oriented schooling system which lacks of the ingredient in developing both sufficient content and generic skills (Yusof et al., 2004; Salleh et al., 2007). Accordingly, several researchers in Engineering Education have found that the current educational systems and practices in Malaysia were unable to meet the necessary generic skills needed by industry (Kamsah, 2004; Gurcharan Singh et al., 2008; Zaharim et al., 2008). In particular, according to Juhdi et al. (2007) agreed that the engineering graduates are well equipped with technical skills, but they lack in generic skills such as an ability to communicate, and are missing the skills to solve problems, along with poor interpersonal skills. These skills are not only demanded by employers, but also the accrediting professional bodies.

The Malaysian Ministry of Higher Education (MoHE), Engineering Accreditation Committee (EAC), Board of Engineers Malaysia (BEM) and the Malaysian Qualification Agency (MQA), have introduced an Outcome-Based Education (OBE) in 2004 to become a fully signatory member of a multinational agreement for the mutual recognition of engineering degrees, i.e. The Washington Accord, Accreditation Board of Engineering and Technology (ABET) (Basri et al., 2004). The traditional approach in teaching where lecturers just give lectures and have the students memorize concepts and theories is no longer relevant (Yasin et al., 2009). OBE has brought about a significant paradigm shift from teacher-centered to student-centered and passive to active learning environment in education and training for Malaysian education system (MQA, 2008; Abdullah et al., 2009). The contributing factor for the curriculum transition is the increase in the number of unemployed graduates each year identified to be lacking generic skills (Shaari et al., 2012).

The focus on the objectives of Engineering Education has evolved from knowledge to skills development as the consequence of the changing demands of employers of engineering graduates (Rompelman, 2000). This paradigm shift has also changed the views on assessment of student learning. Generic skills assessment in engineering is a major challenge within an AL environment (for example, see Nopiah et al., 2009; Cajander et al., 2011). Clayton et al. (2003) suggest that amongst the critical factors impacting the quality of assessment within the learning and teaching environment are: invalid judgement by peers and lecturers'; assessments that are not well defined, assessment inconsistencies; generic skills awareness; quality assurance; and the role of key players to sustain the assessment. No matter how data is presented, there is always the issue of interpretation, although it is helpful to look at the statistical measures (Prince, 2004).

Assessing the students' generic skills in an AL environment demands a careful consideration of various assessment techniques. The consequence of this is, that if lecturers retain the assessment methods they use in their traditional curriculum approaches, the outcome can be a misalignment between their objectives and the student learning outcomes (Mcdonald, 2005; Biggs et al., 2010).

Research Questions

For the exploratory study described in this paper, the objective was to better understand the engineering lecturers' approach on generic skills assessment within an active learning environment in Malaysia. With this increase understanding there is then the potential to develop a strategy to guide better assessment of the generic skills in the future. Specific questions posed were:

How are the generic skills assessment taken places?

What are the barriers to assess the generic skills?

The researcher has conducted exploratory case study in two Malaysian Higher Education institutions. However, this paper only focuses on a single institution.

Methodology

The case study has adopted a purposive sampling approach using predetermined criteria with the aim of identifying information-rich cases which can be studied in depth (Patton, 1990). The selection of the case studies are based on the knowledge of the sample population and the purpose of the study (Noor, 2008; Cresswell, 2009). This technique has various means of implementation. In this study, maximal variation samplings are used. This means that the researcher has performed sampling based on different individuals in some characters (Mason, 2002; Cresswell, 2009). The inclusion criteria use for maximal variation sampling has involved three different characteristics: Individual, Institutional Type and Discipline Focus.

Seven Mechatronics Engineering lecturers who have completed a recognised pedagogic preparation programme and have experience assessing generic skills in one of the Problem-Based Learning (PBL) institution have been selected. The institute has employed PBL since 2010. Characteristics with the populations in terms of gender, religion, ethnicity and level of position have also been considered. These criteria are critically important so that the lecturers' would be able to reflect on and share their actual experiences in the assessment process (Flynn et al., 2004, pp. 16-17).

Semi-structured interviews have been conducted which aim to capture a holistic picture of the lecturers' experience of their practices in generic skills assessment. It also included the lecturers' reflection on experiences over the past year regarding students' results and achievements. Their reflections on what they have done in the past, how it leads to what they are doing now and possibly how they want to assess generic skills differently in the future are some of the main aims of the interview outcomes. The lecturers are also have been asked to justify whether or not the intended learning outcome, pedagogical approach and assessment has been aligned to the curricular and industries demands.

Emerging Findings

PBL was introduced in this case study since 2010. Similar like what has been implemented out there, PBL process in the selected case study starts with students first presented with the problem statement. The students are required to identify and understand what the problem is all about. Then, they need to list down the 3 K's (What they know? What they didn't know? What they need to know), get the information from useful resources, discuss among the group member, finalise the findings and present to the whole class. The lecturer role in PBL has shifted from the knowledge provider to a facilitator which they need to guide and motivates the students to construct their own learning.

Using a qualitative approach has enabled the researcher to investigate the workings of the institutions and the relationships of the participants and their experiences. The process of qualitative analysis uses inductive reasoning, where the themes and categories will emerge from the data through researchers' thorough examination and comparison (Patton, 2002). For the purpose of this paper, there are only two main themes are discussed.

Generic Skills Assessments and its' Challenges

Lecturers' assessment approaches to three generic skills were investigated; verbal communication, problem-solving and teamwork. The findings show the lecturers' initial feedback was generally lacking in substance as they have limited knowledge and experience of assessing generic skills. Although PBL training was provided in earlier stage before the lecturer starts to adopt the approach, none of the training contents related to the generic skills assessment. This factor has added more confusion and resulted less in lecturers' understanding on what they supposed to assess on those skills. Because of non- standard assessment schemes has been designed or introduced, every lecturer has their 'own' interpretation and different way to assess, and some of them didn't assess the skills at all although the skills have stated in the intended learning outcomes.

> *"..there is no schematic assessment, no assessment sheet on what are the portions of those soft skills and no criteria being stated that represent those skills." Participant 1*
>
> *"I didn't do any generic skills assessment because I didn't ask them to do presentation, Q & A session or any viva, I don't have it. All I do is writing test, practical test." Participant 4*
>
> *"I am not including the soft skills in my assessment. If I assess each of the individual students is most probably that the students for those who are really weak in speaking will fail." Participant 6*

In looking for in-depth understanding on this matter, some other quotes from the lecturer include "I am not sure how to evaluate the skills" or "I just assess based on my experience". The findings have also evidence that the assessment are not well aligning with the engineering curricular and teaching methods.

> *".. we had so many group works, many discussions and presentations so there should be more assessments that we can do but we are not" Participant 5*

Most of the lecturer who has conducted the generic skills assessment is assessed solely based on their observations and judgements. No other elements being integrated into the assessment, namely self and peer assessment. It produces a gap for the lecturer to assess those skills.

> *".. we are talking about 50 students for one lecturer to observe, I think that should be quite troublesome to identify each student." Participant 3*

Furthermore, generic skills assessments that have been conducted are focusing on the outcome of the project or presentation rather than progressively evaluation. It is primarily because of the limited knowledge and time to conduct the appraisal.

> *"That is why I said it is difficult to evaluate every student in a short period of time." and ".. if I am required to assess the generic skills, I prefer to assess at the end of the subject, what I mean is the outcome." Participant 6*
>
> *"..say the duration of the class is 72 hours, it is not enough for me to know the student's ability and to assess them on their soft skills. It is a very short time to judge the students." Participant 5*
>
> *".. we don't have a specific tool to measure how far they have improved on their soft skills, and there is no tool specifically prepared." Participant 1*

Verbal communication skills assessment was mostly done during the demonstration, presentation and Questions and Answers (Q & A) session. Fluency and good arrangement of the English language, knowledge on the discussion topics, confidence level and the way the students' manage to answer the question are the criteria being considered during the assessment.

Through the findings, it indicates that the lecturer preferred to assess teamwork skills during the group presentation and Q & A session, but not during group discussion. Criteria like the students' ability to work in a group, sharing knowledge, help others and aware of their responsibility in a group are evaluated during the assessment. Some lecturers assessed the teamwork skills individually and some as a group.

> *"I will ask specific person during Q & A. So that I don't want only one person to dominate in answering for the group, from there you can actually see either they have all the group members really participate during their PBL works or not participating." Participant 3*

Likewise, the problem-solving skills assessment was conducted during the presentation, Q & A session and practical test. Although the students have been educated to use the 3 K's approach when solving the problem, none of the lecturer considers it in during the assessment. The lecturers are more concerned on the students' ability to find resourceful information, how the students can utilise what they have learned previously to solve the problem and process of finding the solution.

Most of the specific attributes that have been considered during the generic skills assessment are based on the lecturer experiences in the industry. There is curricular development done with the collaboration with the industries once in a while, but the focuses are mainly on the technical knowledge and skills, none of the discussion embedded or updated the soft skills attribute that required by the industry. Besides that, the lecturers' lack of initiatives and awareness to up to date with the current technology by incorporating the authentic industrial problem in the class has been identified in the initial data.

> *"There is a lack from my side, actually I have supposed to look what is required in the industries, I mean what is the problem in the industry and bring back to the class as the problem statement." Participant 6*

> *"I have been informed by my friend in the industry that the problem is no longer same like we used to have." Participant 4*

The findings have clearly indicated that although there are many activities prepared to motivate and develop the students' generic skills, only some of them are considered during the assessment. Furthermore, because of the nature of the assessment is too flexible, limited knowledge on the generic skills attribute and lacked of supervision by the institution to monitor the PBL implementation and the assessment progress, has led the assessment deviate from the intended learning outcomes and its objectives.

Discussion: Conceptual Framework

The conceptual framework is designed to provide methods that align the generic skills assessment in Engineering Education with the attainment of the active learning and teaching, and facilitate the achievement of the intended learning outcomes. It is likewise to accommodate what skills that employers expect a graduate engineer to possess. The conceptual framework for this study shows in Figure 1 consists of three concepts (**Higher Education (HE), labour market and employer feedback – Consensus Theory of Employability**). The square boxes outside the big circle represent the input/feedback from industries into the education practice. The circle comprises three concepts (**active learning and teaching, intended outcomes and generic skills assessment - Constructive Alignment Theory**) this represents the implementation of the education system by the lecturer with the student placed in the middle of the circle; this represents a student-centred approach. The work conducted for this paper has informed and partly contributed to the framework, particularly on the lecturers' generic skills assessment of engineering students with regards to learning and teaching approaches, and the intended outcomes.

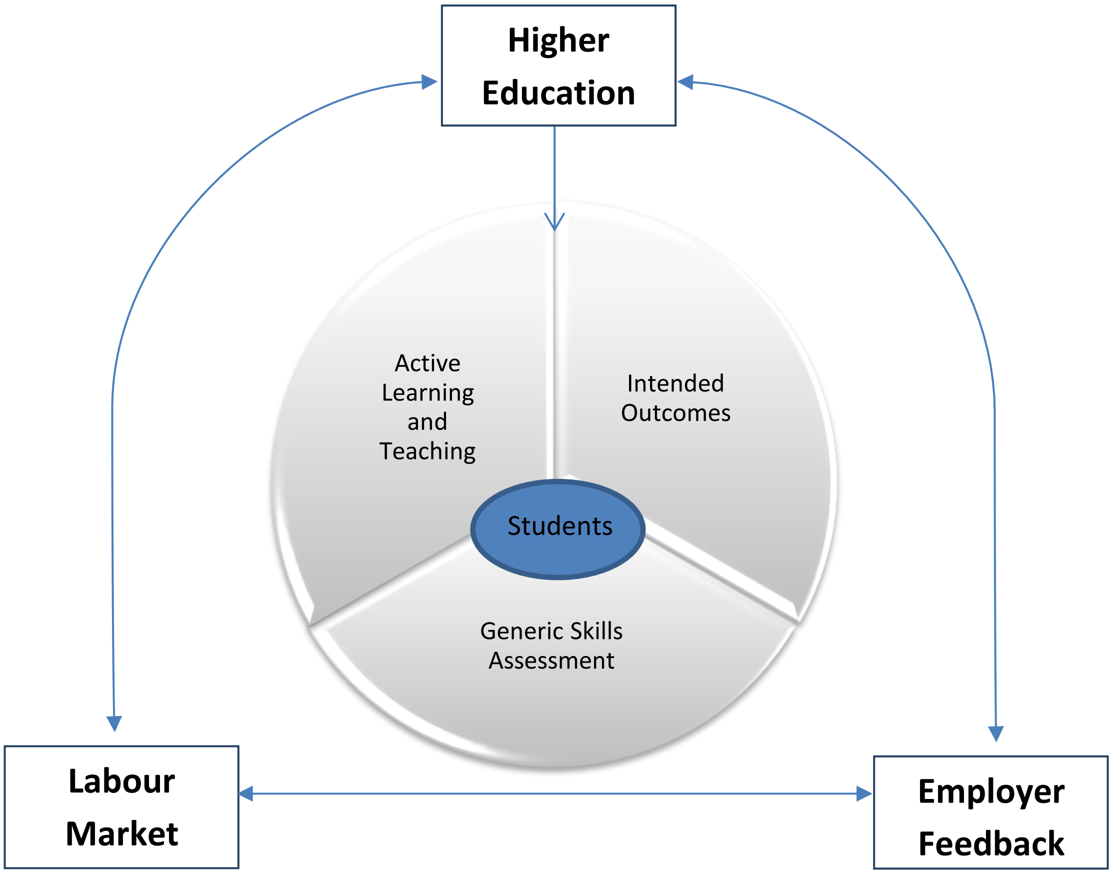

Figure 1: Conceptual framework

Conclusion

In the light of the findings, the exploratory study presented in this paper has highlighted the current implementation and the obvious barriers of engineering lecturers' to assess students' generic skills within an active learning environment. The emerging findings of the interviews reinforce arguments that there is clearly much room for improvement when considering generic skills assessment. Measures need to be put into place to make such assessment both rigorous and quantifiable. In order to achieve this, one of the primary outputs from this PhD study will be an assessment framework; the aim of which will be to guide the generic skills assessment and to improve alignment across the designated learning outcomes and in doing so promote Higher Education standards whilst meeting industry expectations.

Appendix 4 – Abstract for 2015 United Kingdom & Ireland EERS

Employers' Perceptions towards Generic Skills of Active Learning Experienced Graduates in Malaysia Engineering Education – The Emerging Findings

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CONTEXT

International engineering projects and collaborations have become common and are increasing everywhere in the world. Researcher literature in engineering education has discovered that employer criteria in selecting potential engineers, not only depends on academic and technical knowledge, but also on generic skills. Graduates are expected to be equipped with updated generic skills to survive in the challenging industry - specially to become a 21st century international engineer. The perception of the employer on such skills represents an important part of learning and it is this perception which will be discussed.

PURPOSE AND RESEARCH QUESTION

The aim of this paper is to discuss the employers' perceptions and experiences of active learning experienced engineering graduates, specifically in generic skills perspectives, that have emerged during the initial analysis.

APPROACH

Following a case-study methodology, employers' experiences (working with engineering graduates) and their expectation towards three generic skills were investigated; verbal communication, problem-solving and teamwork. Based on the purposive sampling, a total of 10 employers hiring graduates from two Malaysia Higher Education (HE) institutions, were interviewed using semi-structured interview techniques, transcribed, and the transcripts analysed using the thematic analysis.

KEY FINDINGS AND DISCUSSION

Overall, the employers' initial feedback shows that they are unsatisfied with the recent graduates' generic skills performance and felt frustrated with graduates' grades - which hardly represent the skills. Some of the key areas identified in the interview include reasons why it might be happening and what employers see as the most important in areas of the skills and their attributes.

CONCLUSIONS/RECOMMENDATIONS/SUMMARY

In conclusion, the findings emerging from the interviews reinforce the argument that there is a need for the HE to work closely, and maintain a constant engagement with the employer in order to detect the changes in industry, not only the current technologies used, but also to update the skills expected by the employers to better equip the graduates to increase employment opportunities and prospects. In order to achieve this, one of the primary outputs from this PhD study will be the generic skills assessment framework in the active learning environment; the aim of which will be to improve the assessment approaches whilst meeting alignment across the designated learning outcomes and in doing so can help to promote Engineering Education standards whilst meeting industry requirements.

KEYWORDS

Generic skills, active learning, and employers' perception

Appendix 5 – Example of Participants' Transcript from Case Study 1

A. Lecturer's Transcript

Interviewee Name: **CS1L7**

Date of Interview: **24th June, 2014**

Time of Interview: **11.30 AM – 12.26 PM**

Researcher : Assalamualaikum Mr *****. First of all, I would like to thank you for agreed to be interviewed this afternoon. The interview would not take long time, maybe around 45 minutes to one-hour duration which depends on your input. Before we start, could you please verify your name, position and job description in this company?

CS1L7 : My name is *****. I have been a Technical Training Officer like a lecturer in *** for 4 years.

Researcher : What are the subjects are you teaching now?

CS1L7 : Subjects hmm Technical Drawing and CAD, Machine Elements, Machine Designs, Statistical Process Control and Industrial Management.

Researcher : Before you joined ***, do you have any industry experience?

CS1L7 : I worked as Mechanical engineer for Sony EMCS, it is a TV factory since 1997 to 2010.

Researcher : Can you describe more about what are you doing; I mean your job description that time?

CS1L7 : At first I only do mechanical jigs and fixtures. Then I have to do some automation, which basically I used PLC. And then I used microcontroller and computer control. Then we moved to design some machine.

Researcher : You mean machine design and machine assembly?

CS1L7 : Yes.

Researcher : So it is related with what you teach in ***?

CS1L7 : Yes, it is related.

Researcher : Can you share with me your educational background?

CS1L7 : I have a degree in Mechanical Engineering and Applied Mechanics. I have graduated in 1997 and then I do my MSc in Mechatronics. I graduated in 2013.

Researcher : Ok, so you just graduated last year?

CS1L7 : Yes, I am.

Researcher : Since you have experienced in engineering industries and then you came to ***, can I know why you want to join Higher Education?

CS1L7 : Actually my ambition during my high school was to be a lecturer. But I want to gain some experience in the industry. I thought I want to work like two years in the industry but I got stuck working there because the work there is good. I like the work. But still I have some ambition left in me that I want to teach. Then in 2010, actually in 2008, 2009 something like that I started to look for a teaching job that only required a degree holder, because at that time I only have degree.

Researcher : So how do you find working in education, since you have become an engineer before and I t has been 4 years in ***? Any regret?

CS1L7 : I am not regret; actually I prefer to teach theoretical work. I preferred to do that. Although I like technical work, I mean hands on work; I believed that having a strong fundamental theory will help them a lot to solve the problem and to design new things. I can share this knowledge with my students.

Researcher : Before you start to teach the students, does *** provide to you on the teaching training?

CS1L7 : For my first class I have been a seconder meaning I just sit at the back of the class and observe how the senior TTO teach.

Researcher : So you didn’t undergo any kind of teaching training like the pedagogy training?

CS1L7 : No, that is at first. Then after one year I think, I can’t remember when I went to the pedagogy training. That one (silent for 3 seconds) I think it is very good for two weeks training and also I have training for the item construction but that one is only for exam question.

Researcher : I see, at the end of the training, do they assess you on how you teach; is there any kind of assessment?

CS1L7 : Yes, there was an assessment done, basically they called as sit in.

Researcher : Sit in?

CS1L7 : Yes, sit in. I just do some mock teaching but the problem with mock teaching is I usually teach for 4 hours, so the objectives, the flow and everything is actually around 4-5 hours. But the mock teaching is only for one hour. Therefore, it is very different, one-hour teaching with 4 hours teaching. Their comments during that time I don’t think really helpful because like one question they asked where is the transition within this part until this part. When I told them there is a transition, the problem was the what, verifier?

Researcher : Yes. No the assessor.

CS1L7 : Hmmm the assessor was talking during the transition, because the transition was very brief.

Researcher : I see.

CS1L7 : Like 2-3 minutes. They just said where is this come from. This come from this, that is was the transition, they missed that. But they kept complaining about lack of transition.

Researcher : Who usually will become the assessor?

CS1L7 : They were senior lecturers; I don't think they have problem with their teaching method. But I had sit in previously with Ms ******. She was a lecturer and she had formal training on teaching and I really appreciate all her advice but I can take it from her.

Researcher : Can you explain how do you teach in the class?

CS1L7 : In the pedagogy training?

Researcher : No in the class.

CS1L7 : Most of my class is a theoretical class. Even though I teach... No, not the one I like is theoretical class. For example, the Machine Elements, usually I teach for one and the half hour.

Researcher : On the theory?

CS1L7 : Yes, on the theory. And then the students will need to solve the problem for another one and the half hour.

Researcher : Ok, another one and the half hour for problem-solving?

CS1L7 : Yes, problem-solving.

Researcher : What about another two hours of the class?

CS1L7 : We did discussions and Q & A session, and some practical.

Researcher : You have experienced learning in Higher Education before and the how you differ your way of learning with the *** way of learning?

CS1L7 : For my degree?

Researcher : Yes.

CS1L7 : For my degree usually the lecturer was very strong with their theory.

Researcher : Ok.

CS1L7 : Basically all of them can teach without the notes and they can explain deeply about the understanding of any let say basic formulae for example F= ma, they can explain where this comes from the force and things like that. The different from *** is we didn't teach them brief on the theory; we just I can say applied engineering.

Researcher : I see, because if I am not mistaken for a diploma level the Higher Education expectation is whether the students can apply what they have learnt during their programme in their institution. It's a different level.

CS1L7 : Moreover, my degree was in Bachelor of Science in Engineering, so the theory is quite deep.

Researcher : How about the teaching approach?

CS1L7 : The teaching approach?

Researcher : Yes, about how you have experienced now and previously?

CS1L7 : They differentiate between lab and theory class previously. Usually I have not only different classroom but also different code number. For example, physics we have lab and we have class, different code for both. Here we teach students; if we have lab they will get implement in the same classroom with the theory. So the different, I think the good thing about the difference between lab and theory is we know the people who are good in lab and in theory or either one but if we combine it is hard to differentiate between them for the employer to choose their worker.

Researcher : I heard that *** has implemented PBL as their training approach since 2010; do they provide PBL training?

CS1L7 : They conducted a workshop on PBL; but because the first workshop that I have attended and actually the only workshop that I have attended were to teach semester 3 or 4 students, I can't remember much because the subject change from 4 to 3 hours. All the basic things about the PBL already omitted. I think they taught that during semester 1 workshop, I think. So what they told me is how to construct the problem – problem construction.

Researcher : Is it like problem statement?

CS1L7 : No, problem construction.

Researcher : So how do you find your understanding about PBL that time? How many day workshops?

CS1L7 : Only one day. We have to come out with problem for one subject.

Researcher : That is the introduction to PBL and then you to teach using the PBL straightaway?

CS1L7 : Yes, basically. (Both of us laugh)

Researcher : Ok. How do you find level of understanding about PBL say I give you 1-5 where 5 is very good and 1 is very bad?

CS1L7 : I have to say 3 because one class is very good and another class is also very bad. (Both of us laugh) So I can say that it is not really depends on my skill and depends on the class also.

Researcher : Can you describe to me your first experience when teaching the PBL?

CS1L7 : My first experience was very good because the class is very good. When I gave them problem, they only ask me what is my expectation, how far do they need to go. And then they will take it from there.

Researcher : That was student semester?

CS1L7 : 3, I think so. I can't remember but I can still remember the class but can't remember semester 3 or 4.

Researcher : Can you explain to me how did you conduct the PBL class; I mean step by step how did you do it?

CS1L7 : Usually I teach them the basic that they need to know. Then I do some questions.

Researcher : Means the problem?

CS1L7 : Yes, some problems, means just basic problem without any suggestion and things like that. And then I come out with the problem statement which has been constructed during the workshop, I ask them to read first maybe for 5 minutes. Then I ask them if they have any question. After that usually I will leave them for half an hour for them to gather all the information and discuss within the group because I don't want to influence any of their direction. Then I will come back and then I will ask them questions.

Researcher : So they need to answer the problem statement in a group or individually?

CS1L7 : In a group, the least was 4 and the most was 6 students.

Researcher : 4-6 students in a group?

CS1L7 : Yes.

Researcher : Who is responsible to select the group member?

CS1L7 : Me, because I have experience give the students to choose by themselves. It is ended up with all the below average students be in one group, no one chooses them. So, I guess it is not fair for them. Furthermore, later at in the workplace, you will not have a chance to choose your team, it is already decided by your superior.

Researcher : True, you have got a point.

CS1L7 : Whether you like it or not, you have to work together.

Researcher : Do they need to present their solutions or you just ask them individually?

CS1L7 : Not individually. Usually if the presentation only present by one person then only I will ask others individually.

Researcher : I see, you look on the presentation and if only one contribute during the presentation then you will ask others?

CS1L7 : No I mean if the presentation is only take for 5 minutes, then only one person will present.

Researcher : Ok, depends on time.

CS1L7 : Yes, the time allocation to present.

Researcher : How do you think of your first PBL class?

CS1L7 : The first class was easy.

Researcher : Yes, because that is the bright class. (Both of us laugh) Ok. So do you have any bad experience during the PBL?

CS1L7 : I don't think the approach is bad, it is just some of them are not performed during exam but during the discussion they are very lively. There are many answers to many questions, such as during the Q & A session, some came out with good answers and some may not but it shows that they were thinking. Not only that, the students are eager to ask questions, and this has motivated me to update and increase my knowledge before the PBL session is conducted. They give effort, they enjoy in the classroom and that was very good experience.

Researcher : How does students' acceptance towards PBL based on your observation?

CS1L7 : Some students thought that the TTOs' were lazy to teach and that is why we introduced PBL so for them we don't have to do much work. Some will think good of PBL because they have an opportunity to show their talent during the presentation show the leadership or maybe just do whatever they wanted to do when learning, they have the freedom. Hmm some students' complaint that some TTO didn't teach at all, only come and give the problem and ask them to read on the books, this is the feedback from the students. I think there was one student ask me what is actually PBL teach them. Why it is being introduced but I failed to answer the question convincingly. Because I also don't know why is PBL been implemented. During the workshop there is no manual or guide to implement the PBL, I prefer to have a manual because it is like written on the stone where we cannot change it. When I asked one of the facilitator regarding the PBL, she answer different with other facilitator, when I asked one senior, the answer will also different from other senior so I have to draw out the conclusion it is hard for me to draw the conclusion for something that I am not very sure about.

Researcher : But is there any platform, you know someone whom you can refer to, I mean the specialist on PBL?

CS1L7 : Hmm I don't think so. If they have maybe, I am not aware of it. As far as I know they didn't give any reference.

Researcher : Based on your 4 years experienced in PBL, can you describe to me the advantages of PBL?

CS1L7 : The advantages?

Researcher : Yes.

CS1L7 : I think the students who have undergone the PBL will easily develop their skills in the presentation, report writing, social skills, problem-solving skills, how to get the information, how to digest and then give back the information to other people or disseminate the information.

Researcher : What about the disadvantages of doing PBL?

CS1L7 : The disadvantage?

Researcher : Yes.

CS1L7 : For students the disadvantage is for people who is very shy or don't have good social skills, don't know how to express themselves will be a bid disadvantage because they will look like they are not very good students. For a facilitator to conduct 24 students in a classroom is very hard so it is up to the group leader to run the discussion among them. So if the group leader is good, then they can encourage the colleagues to speak more, but if the group leader is not good, maybe only a few people will involve and the other will just be the passenger in various reasons.

Researcher : Ok, talking about the problem statement, how do you develop the problem statement?

CS1L7 : In group. All the TTO that teach the subject will go to that workshop and will discuss how to create the problem statement. Basically, we will refer to the objectives, from the contents and also sometimes what we expect them to get or explore other information.

Researcher : So meaning that you have standardised your problem statement?

CS1L7 : Yes, our aim is to have the same problem statement, but I don't know how is the real implementation. For me, I follow on what we have discussed.

Researcher : Do you standardise the assessment as well?

CS1L7 : We don't have any marking scheme, so it is not standardising because we are not asked to do that during the workshop.

Researcher : You mean you don't have the marking scheme in PBL?

CS1L7 : Yes, the PBL and for the problem statement. We were not taught on how to develop the marking scheme.

Researcher : I see. Ok, we move to the next question. PBL is not only expected to develop students' knowledge and skills on technical, but also expected to develop students' soft or generic skills. It is because through PBL as you mentioned earlier they are exposed to solve a problem in a group and present their findings to the other group and to you. Can I know how do you assess your students' verbal communication skills in your class?

CS1L7: Usually because, like I said I left them about a half hour to avoid help them too much therefore usually it is hard for me to observe and assess them during the group stage. Usually I just check their outcome, meaning what they are reporting and during the presentation.

Researcher: Ok, specifically say for example the verbal communication skills, what are the criteria that you are looking at?

CS1L7 : Usually during the presentation I will observe on how they present and also during the question and answer session. I usually look on their fluency in English, their confidence level and also their knowledge on the topics. One more is their preparation, how prepared they are. Means that when they are present, they elaborate on the presentation slides or they just read it. I want to know whether they are preparing or serious or not, and also for the question and answer I look for their participation percentage. Do they manage to answer the question or not? If they answer, are they reliable answer or not.

Researcher : Ok, that is about their verbal communication skills, what about their teamwork assessment?

CS1L7 : Usually I assess during the presentation also, because I believed that if they are prepared they will contribute much. I also told my students that this is what I am looking for and why, because in real life also we need to alert and give them a reason.

Researcher : Ooo ok, so you mean that you brief them on the objective and some sort like a marking scheme on what you will be looking at?

CS1L7 : Yes, if I want to do the assessment I told them beforehand so that they will try to get most marks.

Researcher : Not all lecturers give the criteria that they are looking at for the assessment.

CS1L7 : Actually, during my first class my students asked me, what are the criteria for presentation? I said that is a good question, on next semester I told them these are what I am looking for.

Researcher : What did you do if one of the group members does not contribute to the group either during the discussion or presentation?

CS1L7 : Usually during question and answer I give the opportunity to this student to answer, means I choose particular person to answer my question so that I can know whether he contribute or he/she just shy.

Researcher : Do you have any bad experience on the students' teamwork in your class or maybe during the FYP? Because in class the lecturer is still in the class to observe but during the FYP I believed they are in the workshop and maybe you are in the office, how do you manage to observe their soft skills?

CS1L7 : Usually during the meeting I will ask their current task.

Researcher : How frequent is the meeting?

CS1L7 : Usually for the first month I met them every week, for second month, maybe less but for last month again every week.

Researcher : Do you assess them on their soft skills during the meeting?

CS1L7 : No, I don't assess their generic skills. The meeting is just for monitoring their progress.

Researcher : When does actually the soft skills assessment happen?

CS1L7 : After the presentation.

Researcher : Internal or external?

CS1L7 : External presentation because of internal usually the project is not finished yet. After external I ask them to show how the machine works, one by one.

Researcher : Do you assess them on technical only or with the soft skills as well?

CS1L7 : For the soft skills, there is no assessment because they follow the standard assessment sheet. The soft skills I think the external verifier will indirectly assess because from what I can see usually the best presentation during external will be the best project for overall. Good project is the best presentation.

Researcher : Do you have some kind like a rubric assessment?

CS1L7 : What? Rubric?

Researcher : Yes, rubric like for example you give marks 1-5, 1 is for what, 2 is what and so on.

CS1L7 : O yeah, for FYP?

Researcher : Yes.

CS1L7 : Yes, it is a standard sheet, they have like for example feasibility studies, how is their knowledge, 1 they can describe in depth something like that, I don't remember, yes we have that kind of assessment. Usually the coordinator for FYP will design that assessment sheet.

Researcher : I heard there are progress assessments during the FYP, Progress 1, 2, 3 and so on which they need to reach certain milestone during each progress. Have you heard about that?

CS1L7 : Yes, that one is done by the FYP coordinator.

Researcher : Hmm before I forgot can I know, what are the attributes that you are looking at for the problem-solving?

CS1L7 : Usually I just look at the outcome but if they come out with something special I will ask them how they get this information.

Researcher : Can you describe what do you mean by special?

CS1L7 : For example, if I ask them to do a presentation about sensors. Usually they will get it from books and present it and it, so that is not so special. Suddenly one student comes out with special sensor, and then I will ask him where he got this information. Just to share with me and also other student. It is just some sources of information which they can explore. Maybe like I ask them to present something about one safety rule, suddenly they come out with five safety rules, so I will ask him where this safety rules come from, it is basically his initiative to look for it.

Researcher : And you can learn from them as well?

CS1L7 : Yes, I can learn from them and also other students can share.

Researcher : Yes, that is the good thing about the Problem-Based Learning actually you are not limiting your knowledge like what we had in the text book or hand out only, it can go beyond that level. Ok, since most of the time they need to search for the information during the PBL, how do you find the facilities in *** to provide such environment to the students?

CS1L7 : For my class usually I only used internet. The problems with students are usually will deviate from the problem, they will focus for the first ten minutes and then they will search something else. (Both of us laugh) I don’t want to scold them for that, it is still under control. For going the library, I think, it will take too much time that is why usually I would prefer them to do using the internet, because in real life we also try to find information through the internet.

Researcher : Ok, but when they start to refer to the internet, how do you control the plagiarism, whether they are copied from the internet for their report or assignment?

CS1L7 : I think if they copied from the internet and they copied directly without changing anything I can just copy their report, some point in the report, put it in the google, then I can find if they are copy. But for one and half hour problem-solving and presentation usually I let them to copy as long as they can present good and they can understand in what they are talking about.

Researcher : Yes, I quite agree with you, the most important thing is the knowledge whether they can understand or not.

CS1L7 : But for report writing I am quite strict.

Researcher : Ok we have discussed about your teaching experience in ***, students’ acceptance towards PBL, how you have conducted the PBL sessions, what are the advantages and disadvantages of PBL, and so on. Do you have anything that you have missed out and you want to add some more?

CS1L7 : About the PBL?

Researcher : Anything, for example maybe suggestion on how to improve the PBL or generic skills assessment or what so ever.

CS1L7 : I think the implementation is good.

Researcher : You mean the PBL implementation now is good?

CS1L7 : No I mean if we can implement the PBL in a right way it will be good. But most of the TTO that I have asked they also not understand the PBL meaning they don't know how to assess, they don't know how to.. to conduct, to facilitate the PBL correctly. For the leader I think Mr Ngan, he said he can understand well but for me it is hard to understand just from like 15 or 30 minutes talk. Maybe it will be good if we can, for me I like to read so if they can suggest a good reading for PBL for technical people like a bible something like that. And then I think some classes are good in PBL and some are not, so I prefer if they let the TTO to choose whether to use PBL or other method.

Researcher : When you said to use PBL or other method, so how you want to standardise in sense of a, first in sense of the assessment will be difference, because we choose the conventional method with PBL in the way we teach is quite different. I think the learning objectives, the course content and syllabus maybe will be the same, it is just I concern about the assessment, what do you think?

CS1L7 : What I meant is for one subject we want to use PBL so every TTO will have to use PBL but for another subject for example we don't want to use PBL, so other TTO also will not using the PBL.

Researcher : I see. The main reason why I asking you about the assessment because we try to be fair as much as we can for the students in the same badge, because I heard you have different group of students and different TTO will teach so we need to try to have the same level of difficulties and so on. Yes, it is a good suggestion.

CS1L7 : For example, like Physics, I don't think it is suitable to use PBL, because for me every student need to master the fundamental. For application classes it is very good to use PBL because they want to like integrate many components so they have to learn by themselves. That is my opinion, I don't know about others.

Researcher : Yes, yes I really appreciate your opinion since you have long experience in the industries so you know how the engineering industry apply and require for the fresh graduates. And now you know the Higher Education level in sense of their knowledge, their soft skills whether or not they can meet with the employer expectation. So that is why your input is very important to this research.

CS1L7 : Because one of my colleagues was not very good in his exams result, was not excellent but still ok, 3.++ but what makes his results lower because he likes to do project on his own.

Researcher : Not in a group?

CS1L7 : I mean not in project class, just hobby. So when he works, he can apply all his basic knowledge in his design. But for people who only do the theory and what he learnt in class, when they are given the problem they don't know how to solve it. For example, how to calculate the capacitance for this problem, why this problem happened, which component is faulty, they don't know how to solve. Just trial and error, no scientific explanation, but for this guy, he is very good. He can calculate, for example this problem, he said it comes from this, therefore this is the calculation and he justified with scientific measures because he has many experience in solving real problem.

Researcher : What you have mentioned is like the PBL as well, problems are generated from the authentic environment with the technology getting higher and higher. So the problem from 10 years ago is different with the problem that we are facing now.

CS1L7 : That is the problem, in the problem statement construction, we have to finish within one day, infact in a couple of hours (both of us laugh) by referring to the books and we just create the situation.

Researcher : I see; the problem might be outdated.

CS1L7 : Fortunately for my Machine Element it is almost the same thing for the past 15 years.

Researcher : So it does not have much change?

CS1L7 : Yes. If we want to add problem statement with latest technologies, then we need to add more hours for the theory class, therefore we cannot add too much without getting rid things but the basic is still very important area.

Researcher : You said not enough hours, so in your implementation during the PBL do you think it is enough for you to do the PBL?

CS1L7: The duration is depending on the students' if the students are good, then they will solve the problem in short time. If not, I have to add some more time or I have to just shorten the PBL and guide them with the solution.

Researcher : Do you do any kind of feedback or reflection at the end of the discussion?

CS1L7 : Usually I only tell them what they need to know, for example.

Researcher : So you are not giving them the solution?

CS1L7 : I mean sometimes they got something from the internet, but they misunderstand, so I just explain actually this is what it means.

Researcher : So you clarify back the statement?

CS1L7 : Yes, I have to verify all the information that they got. And sometimes I just give them hints on what they did wrong about the presentation, what is better from my experience because I don't think I am a good presenter but theoretically I know what need to be done.

Researcher : Ok, I have a last question. Since *** has adapted PBL approach since 2010 and now is 2014, has they did any research on the students' performance compare to the previous approach?

CS1L7 : I think last semester, there is a questionnaire given to students, but I am not sure what is the questionnaire consists of.

Researcher : But is it related to PBL?

CS1L7 : I don't think about the students' satisfaction because when I ask the student to fill in and they pass to me back so I read the questionnaire. It is about the teaching method and feedback about the classroom.

Researcher : Based on your experience, how do you find *** students' performance?

CS1L7 : Ooo I started here in 2010, so it is already PBL.

Researcher : Yes, but if I am not mistaken in 2010, it is only applied to the first semester or does it applied to whole semester?

CS1L7 : I don't see any improvement in students' performance.

Researcher : No improvement?

CS1L7 : If I look at the FYP, I don't think there is any improvement in their presentation skills.

Researcher : Ok. What about their knowledge or their results getting higher?

CS1L7 : I think *** already lowered their admission standard so it is hard to gauge the success rate of PBL. But if we really want to measure their performance, we need to assess them progressively starting from the beginning they are in *** until the end of the final year, so we can know what kind of students we have produced and whether they have improved or not, because sometimes improvement comes with age.

Researcher : Yes, the maturity of the students. Is there anything else you want to add?

CS1L7 : Ok, I think PBL approach is good because its assessment is like what the industry people will assess you during your working discipline. Because without realizing it people will grade or judge you based on what you did, what you have presented and so on. That is why I think the approach is very good as long as the TTO know how to implement them in class and if you can convince the students that it is the good way to learn and the students can accept it and later admit that yes it is a good way to learn. Sometimes the negative feedback only because they have a mind-set where the TTO who did this is lazy or this is just to save cost where actually this is a good way for them to learn on their skills, on their working skills or generic skills.

Researcher : I think it is because of they are not presented well in the PBL knowledge, how to undergo the approach and so on. That is why in their mind they have that kind of speculation on the TTO.

CS1L7 : The TTO also need some guideline and proper training on how to react for this kind of situation or this kind of mind set.

Researcher : Yes, true.

CS1L7 : Because during my previous working condition if you don't do your work, you can just go.

Researcher : In Sony?

CS1L7 : Yes, in Sony, if you didn't do the work they will scold you until you do your work or transfer them to other places, but it is not suitable for the classroom situation.

Researcher : Ok, thank you, Mr ***** for your time and sharing your experience with me. I really appreciate your input.

CS1L7 : Your welcome.

B. Student's Transcript

Interviewee Name: CS1S7

Date of Interview: 28th May, 2014

Time of Interview: 15.00 PM – 15.55 PM

Researcher : Hello *****, first of all I would like to thank you for agreed to be interviewed this afternoon. The interview will not take long; it maybe takes about 45 minutes to one-hour duration. Before we start further could you please verify your name and your background?

CS1S7: My name is *****. I am from Ipoh, Perak. My age is 23 years old. And then my ahh before I come to ***, my previous study is MHSC. And then I come from family which have ahh 5 people; my father, my mother and two sisters.

Researcher : So are you the youngest?

CS1S7: No. One of my sisters is in polytechnic and another one is form 5.

Researcher : When you said you have MHSC; are you enrol in *** using MHSC or MCE result?

CS1S7: I guess both.

Researcher : Ok, if you look at this form right, there is a definition of active learning. Could you please read by yourself? (After few seconds)

CS1S7: Ok.

Researcher : Ok, based on this definition can you refresh back your mind, how it differentiates the learning environment in your previous school and learning environment in ***?

CS1S7: Normally in our ***, they are using the PBL- Problem-Based Learning. TTO will give us a problem based on what we learnt for example like, for example Physics. In physics we learn what it calls speed of something. The PBL is like when come down from stairs, what will be your speed? Or so on. Like in our school, they will just, normally they won't give us that type of PBL. Normally they give us like questions, answers or they give us portfolio to do or experiments do in lab that will be guided by our teacher. But in ***, the Problem-Based Learning is normally you are the one who conduct the experiment, you are the one who guide yourself, you are the one who find the information so what the result that you get from your experiment or something that is your information or that is your experience for the subject, haaa like that.

Researcher : What about the learning during the school if you compare the learning in ***? About the teachers you know?

CS1S7: Compare to school they are more in lecturing, in school they are lecturing, lecturing, lecturing. In *** they are more after you are trained they will give you to do experiment, project, give us some problem and you will conduct by yourself. In school normally, I can say 80% is lecturing, 20% is for learning activity like experiment or something. In *** normally one class four hours, two hours learning activity and another two hours is experiment based on what TTO has taught of that day.

Researcher : So they will be a lecturing during the PBL?

CS1S7: Err.. Lecturing no, they will just, normally TTO will just brief and explain what PBL is all about, what is the problem and then the TTO will observe the students doing their work.

Researcher : When is the first time you experienced PBL?

CS1S7: First time during the first semester, first class ehh not first class, third or fourth class I guess.

Researcher : Third or fourth class? During the first semester.

CS1S7: Yes.

Researcher : How do find PBL in the first place, do you feel shock?

CS1S7: Most likely in previous school, we don't have a PBL. We just have experiment or something where they guide you. If you don't have, hmm normally when we asked questions the teacher will directly answer. In ***, because we have a PBL, if we asked, we conduct the PBL by our self, if you asked questions teacher won't directly give you the answer. They will just like guide you, for example how to solve this. Firstly, you think like this and like this, then present what you get and the TTO said try to think by yourself. And then we must ahh, how to say ehh, we must involve the critical thinking, we also study with other friends because we do work in group. And then we study among the group, solve the problem within the group and last time we normally we did not do that. When we don't know we asked the teacher.

Researcher : That is during the school?

CS1S7: Yes, during the school. *** don't have.

Researcher : Ok, when I look at your demographic background, you are from MHSC. Can I know why did you choose Engineering?

CS1S7: Engineering because previously I am also doing part time job with my uncle in the car workshop. So from there I like to assemble their engine or something like that. I like this type of activity. So that is why I choose engineering. And then besides that, I am better in sense of Physics and Mathematics so my teacher also suggests me to go for *** because his son go to Singapore Japan Institute or what, Singapore and Japan conduct an institute, so he said Malaysia got one institute called ***, so he suggested me to enter and takes Mechatronics course. Because he said Mechatronics course is considering quite new, he said like that. And then he said because you like Mechanical and something, Mechanical now is something a little bit out dated because now is more in Mechanical and Electronics, so he suggested me to take Mechatronics.

Researcher : I see. You have read the active learning definition, you have undergone few sessions, not few sessions, how many PBL you have in average for each subject?

CS1S7: Every semester and every subject we have PBL. One or two PBL at least in one subject. The number of PBL is based on the timeframe, if we don't have enough time we normally get one PBL and if we got enough time then we will have two to three sessions.

Researcher : I have been informed that in ***, during semester 1 to semester 3, you will be focusing in general studies and semester 4 to 6 you are focused on the technical, yes?

CS1S7: Yes.

Researcher : Ahh, how difference PBL in general studies and PBL in technical subject?

CS1S7: Hmm for example in general studies the PBL we still can get information based on books in the library and something because like Electric and Electronics we have a guidance book and for the technical like in Pneumatics and Hydraulics, in Sensors something like that we don't guide by the books so we need to find information through internet and then the answer should be more technically because more technically. And then in general studies, they are more like in general, they kind like how do we say this like for example Electrical and Electronics, they normally will just give PBL for example what is the current, how is the calculation of this. And in sense of technical like Pneumatics and Hydraulics you must show how the process is flow and then if they involving with Electrical and Electronic, what is the input, output? In technical they also involving general study, because we apply back what we have learnt previously.

Researcher : Yes, just to refresh back your knowledge. Ok, can I know what is the advantage of doing the PBL?

CS1S7: Ahh when we study using a PBL, we are the one who dig all the information, we are the one who find the information, we don't rely based on the book, we don't rely on TTO knowledge because sometimes TTO also said that their knowledge is not updated, sometimes is not updated so you are the one who should study, you are the one who should fine the information. He said during his experience in university normally the lecturer just lecturing for one hour and then they will give you question and then class end. You are the one who responsible to search the information, you need to learn from the PBL. PBL is like a guideline so that you start to learn, find the information, find the updated information and then it would be easier when you study in university. So in PBL we can dig out more information, we can compare the information and from there we can choose which information is useful, which information is not correct, which information is more correct and like that.

Researcher : Ok that is about the advantages of PBL, what about the disadvantages?

CS1S7: Disadvantages, errr I don't think got disadvantages. The bad is based on personal I guess. How to say? Because PBL I don't think they got disadvantages except for personal. If in the group of 5 peoples, only one or two person really want to do the task, others are just like to be a passenger, sit tight, wait for result and then present.

Researcher : But then when you are doing the group work, don't you like separate your task among the group members?

CS1S7: Yes, separate task but the problem is after separate task the person don't want to do. Ok I say, you do this task and you do this, they don't want and then that forced me to take their task because I don't do it we will not have marks or something like that. So that is the disadvantages I guess. But the disadvantages are not based on PBL but based more in personality.

Researcher : Ok, if that is the case, if you are given the opportunity to improve PBL what would it be?

CS1S7: Ok on PBL, they always give mark based on the presentation on grouping not based on the individual for example in overall group presentation we just present, ok after the presentation the result is good, acceptable ok this is the marks for the grouping.

Researcher : Ohh there is no individual mark?

CS1S7: No, no. That is why I think it is unfair for somebody who really works hard on it. The lecturer said that teamwork marks are given equally in a group. Because based on the presentation you can see that who are the one who really work and who are the one who didn't work. Because he is the person who gives effort doing work, they will know how to present or something. If the person didn't show effort, then they will just read from the slides for example if present through the power point. If conducting the experiment, during the question and answer session, mostly the people or the person who didn't give effort and didn't do their work or task, they can't answer all the questions but mostly TTO just give marks in group. They said it is easier. They don't want to take; they don't want to do more job like that.

Researcher : I see, ok what else besides the individual mark?

CS1S7: Sometime I see some of the PBL, they just giving a problem in a paper form because I heard some of TTO said Problem-Based Learning is based on the authentic problem that ahhh the TTO think and should be out of the box. They like, for example last time my Physics teacher just gives example like a treasure is in the sea and then you are the captain of the ship, and you want to get the treasure from under the sea, so calculate what is the buoyance force something like that. He thinks of the question immediately but most of the TTO they just print out and then just gives the same questions like the previous class doing. They just give the same questions. So mostly we can get the answer based on mostly from the senior. My friends always do the PBL and then get answers from the senior. That is the disadvantage and it should be improved.

Researcher : What about in sense of the time, duration of doing the PBL?

CS1S7: Duration I think is enough. They normally give us one or two weeks to prepare.

Researcher : I see, before the presentation?

CS1S7: Yes, enough.

Researcher : So means they give you one or two weeks the problem and then you need to work out the solution within that duration?

CS1S7: Yes.

Researcher : Ok, instead of asking the… (Participant phone ringing, he has to answer the phone)

CS1S7: I am sorry sir.

Researcher : It is ok. When you are doing the PBL, I get information saying that there is a procedure called the 3 K's. Do you know what is the 3 K's is?

CS1S7: Yes, 3 K's is known, don't know and need to know. It means that based on the problem what you know, and then what you don't know about for the problem, for example aaaa in Hydraulics they give us a question that like we pump water from aaa you get the water from the main pipe until to the end or through your house or something, for example. And then based on the question what have you know, what you don't know you must list it and then what you need to know. What you know is based on the general, what you don't know is what you need to find out and what you need to know so that the system is functioning. That is the 3 K's. Now mostly.

Researcher : But do you apply the system to every subject.

CS1S7: No, not to all subjects.

Researcher : Is it only applicable to general studies or technical?

CS1S7: Aaaa because aaaa this 3 K's we are confused about don't know and need to know. Don't know is mean what is really don't know and what you need to know is also you don't know and need to know. Then sometime it is confusing and when we asked the TTO, the TTO also confused about it.

Researcher : TTO also confused? Really?

CS1S7: Yes, really.

Researcher : Ok, there is definition here about the generic skills. Please read by yourself.

CS1S7: (After few seconds) Ok.

Researcher : Based on this definition, have you developed those skills throughout the PBL approach during your learning in ***?

CS1S7: Yes. From PBL first the most important is the teamwork. Mostly in PBL, we must work in a group and you cannot do by yourself only. So to have a good teamwork, you must separate task and then you need to communicate to each other so we can know what is the information that this person gets from their task and so on. So teamwork is very important because PBL also, we also implement PBL during semester 6 in FYP. Because when we are doing the FYP we might face a problem in technical or electrical problem. Then we will sit down and think why this problem happened. So we will discuss among the group member and then we need to solve the problem so that the machine can function together.

Researcher : Ok, when you said you are doing works in a team, how in the first place you decide your team members? Is it decided by the TTO or by yourself?

CS1S7: Normally we prefer to decide by our self.

Researcher : So you have an option whether to decide by yourself or the TTO?

CS1S7: The TTO usually asked whether we want to decide by ourselves or the TTO will help us to decide. But some of the lecturer they prefer to choose by themselves because they said if we choose, we only choose the selected person, like that I prefer to choose always these 4 persons and won't grouping with others. That is why some TTO prefer to choose for us.

Researcher : Ok. If they let you to decide to choose your own group member, what are the criteria that you will look at?

CS1S7: Firstly, myself I will decide mainly based on the person who can perform the work in a team. For example, if I give him a task, will you do it? That is the main criteria I will look at. Because I don't want to choose 5 lazy people which at the end I am the one who need to do their work. So, why I want to do PBL with them? So normally I will choose the people who really want to do and second requirement I will choose people who have technical skills or knowledge in few disciplines. Because some of the students they have knowledge better than me and some might not have knowledge but they willing to do work. I will also accept to be in my group.

Researcher : Alright. So how do you find your team has showed their efforts doing the project?

CS1S7: Basically before they put effort in doing the project including now in the FYP they also discuss, ok I take part in one section, someone will do the Mechanical, someone in Electronics, some doing documentation, some doing the presentation slides, some find information, each of them are doing their work.

Researcher : OK, what about you, what have you in charge with?

CS1S7: Normally I in charge with the documentation like purchasing, solving problem in Mechanical part I have given to two of my friends who have strong background. One of them has experienced doing project in his brother company working for Petronas.

Researcher : Ooo ok.

CS1S7: So he has experience.

Researcher : Ok, what are the difficulties that you have faced during the teamwork? Do you have bad experience?

CS1S7: Yeah.

Researcher : What is it?

CS1S7: Aaaaa… For example, I hmm, after we present, in the presentation he doesn't do any work and always give an excuse that he need to go home because my mum wants me to go home or something. And then aaa like for example Monday is the presentation day, so we do all the works, he supposed to find information in general like for example I have find for him the information about the sensors, find the webpage about the sensors and ok this is the webpage, you just go to the webpage and find the information, that's all. And Saturday and Sunday we are doing the slides, he said my mother called me and I need to go back home. And then he just goes and he said Monday I will come back, just let me know which part I need to present. And then after present, we need to do report, he also gave the same excuse that I need to go back home, my mother called. And then Monday afternoon we need to pass up the report, I have assigned him, you need this part in this report. But he said he need to go back home. I said never mind just go back home and do it at your house. Until Monday morning, he said I haven't done the report, and I said never mind I have laptop you do in front of me.

Researcher : Really? Until that stage?

CS1S7: Yeah.

Researcher : That is really bad experience.

CS1S7: Very bad. Very bad. (Both of us laugh)

Researcher : Ok, in my experience I have seen students hate to do presentation. What about you?

CS1S7: Last time I also don't like to present, I really scared to present in front of people.

Researcher : You meant last time, before you enter *** or during your school time?

CS1S7: Yes, before enter ***. And then until form 5, form 5 I have become a head prefect so I need to give a speech in front of the crowd of student.

Researcher : Ok.

CS1S7: And then from there I have been trained to not be scared giving speech or present like that. So after enter the ***, when I am facing the PBL, I am not facing a lot of problem in terms of the communication.

Researcher : I heard you have presentation in every subject, am I right?

CS1S7: Yes, two or three presentation in each subject.

Researcher : So that's help you to develop your confidence?

CS1S7: Yes.

Researcher : How do find your presentation skills now compare to before?

CS1S7: Stronger based on my lecturer or my TTO feedback to me. Like for example the FYP presentation that is just conducted yesterday, they said my presentation skill is quite ok except for another few people in my group who are just read the slides. But I also cannot blame them because mostly they are doing the Mechanical parts until the time before the presentation, because they need to find out what are the problems so that the machine can function and ready to demonstrate. So they don't have time to prepare themselves to look at the slides that is why they read during the presentation.

Researcher : Is your project now functioning well?

CS1S7: No still have problem in terms of the programming. Because in programming we have programmed the cylinder should be extending after this station but it did not extend.

Researcher : How do you start writing the program, do you use the Step Sequence Diagram (SSD)?

CS1S7: Yes, follow the diagram. And then my friend also said that first time we test it can be extending the cylinder, for example I have one drilling station, sensor detect the object under the station it will extend. Firstly, we test it is successful to extend the drill cylinder. And after that my change a few, because my Mechanical friend, he exchanged how to say this, the reed switches for the cylinder and then not according to the SSD that I want. So my friend decided to change the programming and changing the position of the reed switch. After change the position of the reed switch the cylinder don't extend. The cylinder of the drill is not extending. So until now we are still wondering why.

Researcher : I think it is because of your assignment list which you need to update back since you change the reed switch. Ok, back to our discussion, when you communicate with your team member, when there is an argument, how do you handle that kind of situation?

CS1S7: First I try to consult with them, if after the discussion we still cannot get the decision and we still argue and then I will stop the discussion, go back home, cool down yourself. The next day we will try to discuss again, because if you continue to discuss after we feel mad or something, it will not good for the team. So if we argue and argue, if I see that something wrong and we still arguing, ok we just stop the discussion, go back and cool down our self. After tomorrow we continue to discuss. I prefer like that. Because when we have argument in team, I don't like to be my friend who just scolded their team members if they didn't do what he said. I don't like to do that; we are already adult, matured. How to say ehh, they can think by themselves. So I don't like to say you must do this, you must do that. I don't like to force people.

Researcher : But you didn't involve your supervisor or TTO?

CS1S7: I will try to solve the problem internally, but if it can be solved I will talk with them, my supervisor. Then my supervisor will talk to others.

Researcher : Ok now we are going to talk about the problem-solving, instead of the 3 K's do you have any other way to solve a problem because you said the 3 K's is not applicable every subject. So how do you without the 3 K's?

CS1S7: Basically I will rectify on what the problem wants. And then I will try to find information or refer the case that have the similar situation with the problem. Haaa similar situation and from there I will find the solution. I do not prefer the 3 K's because it makes me confused so I just list know and don't know.

Researcher : So just 2 K's? Know and don't know?

CS1S7: Yes, what I know and don't know. Because for me don't know and need to know is the same thing.

Researcher : Yes, because if you don't know, that is the thing you need to know.

CS1S7: Yeah, from there I just list what I know and what I don't know. If I list, I don't know I can understand it clearly. So like that I guess.

Researcher : To find the solution and information relating to the problem, which source are you referring to?

CS1S7: I will use the internet, sometimes also called my friends, asked the TTO. I also called my previous school teacher to get some information.

Researcher : Ooo ok. Does the teacher manage to help you?

CS1S7: Yes.

Researcher : What about the TTO here, for example you learnt in Sensors, who taught you?

CS1S7: Hmmm sensor, hmmm I forgot sir.

Researcher : Ok say for example Sir A, and then you can't find the solution for that problem; can you asked any other TTO besides Sir A?

CS1S7: Hmm I also asked my friend in other class. How do they get information? Because they also do the same problems. Some are same and some are not similar.

If they do the similar PBL, I will ask the how do you get the information and then they said my TTO gave suggestion like that. I will consider the suggestion.

Researcher : But they do cooperate with you right?

CS1S7: Yeah.

Researcher : What about other TTO?

CS1S7: No I guess. I seldom asked other TTO.

Researcher : Say for example you have problem in programming, if I am not mistaken Sir Heidir in the specialist in the programming, are referring other TTO besides him?

CS1S7: Yes, for programming I also asked other TTO because some of the TTO for example my supervisor is in charged in PLC or something.

Researcher : Who is your supervisor?

CS1S7: Miss *****. I also asked the information from her and from other TTO who taught me CIM, Computer Integrated Manufacturing. She also has the information about the PLC programming.

Researcher : What is her name?

CS1S7: Miss *****. Like in terms of electrical and electronics, I also get information from other TTO.

Researcher : Ok, when we talking about the generic skills, say for example the communication, you said they mostly assessed you during the presentation, what are the criteria they are looking at for your communication skills?

CS1S7: Mostly aaaa, I think aaa, I don't notice what they have in the marking scheme. Mostly they will take note that how you present, how is your influence, how to say, how do you influenced your audience in your presentation, are you talking fluently because some of them are just reading the slides and some of them present like urmm such sound, they mumbled. They do not have confidence; maybe they do not know what they are presenting. I think that contribute to most of the mark. For example, yesterday I have presented, the TTO said ***** can present without reading or something. Other 4 members they just reading from the slides only and then during the Q & A session they did not manage to answer. So this proved that they are not good in sense of their presentation skills, some of them during reading they also find problem in terms their reading skills because most of them are not good in English.

Researcher : So that's why they did not confident to answer the question and so on?

CS1S7: Yes, I guess so.

Researcher : Ok, when you said about the marking scheme, does the TTO or your supervisor let you know the details of the marking scheme, what sort of criteria they are looking at?

CS1S7: Actually after we finished the presentation and then he will say based on the marking scheme you don't have for example your slides lack of information, like that. For example, they said in internal and external presentation the marking scheme is same. So that they will give us information like your presentation is lacked of this and this and then the will say your presentation skill is poor or something like that so you need to improve it. There is class with projector available besides this room for us to use or do a mock presentation.

Researcher : Ok, so they didn't let you know the marking scheme before the internal presentation?

CS1S7: No. But I think we can ask to see the marking scheme.

Researcher : And you didn't ask for it?

CS1S7: No.

Researcher : Ok, instead of the marking scheme, say for example during the introduction to the Final Year Project module, does the TTO or your supervisor explain to you what are the learning outcomes for the module?

CS1S7: What do mean by that?

Researcher : The learning outcomes, it always stated that at the end of this module the students should be able to for example communicate with others, or be able to do work in a group and so on. Have you been acknowledged something like that?

CS1S7: Normally the lecturer will highlight the learning outcome earlier in the first class of the subject and it is also including in the notes on the first two pages. Basically the learning outcome is almost the same.

Researcher : But I think different subject will have different learning outcomes?

CS1S7: Yes. Because say working in group so the, hmm if you are working in group mostly the learning outcome will almost the same. And then during the FYP, you implement all your knowledge so the outcome is about the same on the previous on what you have learnt. Because we just apply in our project. Basically it is the same so our supervisor won't repeat telling us the learning outcome.

Researcher : Ok, just now we have talked about the assessment of the communication, what about the assessment of the teamwork, what are the criteria to assess your teamwork skills?

CS1S7: The assessment of the teamwork is based on what had been our supervisor observation. Because the teamwork usually the marks are given by our supervisor. Because every week we need to pass up our weekly report, the comment from the group leader and then what have they been doing, what the leader have report for each group member, so based on that and then their attendance as well. From there the supervisor will take note and sometimes supervisor will come to the room and make his own observation while we are doing our works. So based on the observation the marks will be given based on a group marks. And also have the KQ.

Researcher : What is KQ mean?

CS1S7: Key Qualification. Like are you punctual, are you doing works that is more for individual. Every time during the group discussion or group working in project if one of the group members always do not attends the group discussions or working and the TTO noticed that and then they will deduct mark from the KQ. Because KQ is a hmm individual mark so the TTO will deduct based on their punctuality, attendance, if you give effort doing the work, are you giving cooperation with your team, like that.

Researcher : Ok, to avoid the bias in giving marks, how do you think we can eliminate or decrease the biasness of the lecturer or the TTO?

CS1S7: That is the job of the group leader.

Researcher : How is that?

CS1S7: Because the group leader is the one who distribute the task, the group leader will write down the weekly report, attendance so the group leader should be fair in reporting the information. So if for example the group have 5 persons but every time only 4 persons who doing the work so the group leader should take note and then write in the attendance. This to avoid the group member for not doing their work and then always give excuse, then gives the supervisor to sign means to acknowledge the situation before pass the report to the head of department for filing the documentation or for further reference. So from there the supervisor will take note that he will know that this person, this member always does not come to the group discussion or something. So that the supervisor will try to talk with the person why are you doing this and why are you doing that. So that is why the group leader should be fair, if he is not fair it will drag other people rights. Because mostly the supervisor cannot always come down to observe so that the group leader should play their roles.

Researcher : Ok, what about the problem-solving? How do they assess your problem-solving skills?

CS1S7: Aaaaaa based on their knowledge because some of the person has the knowledge about certain things for example we got problem in terms of sensor, so we discuss among the group and then for the person who don't have the knowledge or is not good in sensor they learn from someone who knows. Another thing is team member effort to solve the problem for example how to repair it; we found that the sensor not working because of the wiring problem, a discussion will be made and then people who do not contribute the ideas, how to say this ahh, people do not give more effort during the discussion session they need to give more effort during the wiring. So it will become balance and fair.

Researcher : So what you mean is the lecturer or the TTO will give marks throughout the process and not the outcome of the problem?

CS1S7: Yes.

Researcher : I see, next, could you please suggest on how to improve the generic skills assessment because mostly the assessment is depending on the TTO, supervisor or the group leader observation right? How do you think we can improve the assessment to be fair for the students and the TTOs'?

CS1S7: Ok, the TTO is not only depends on the group leader, they also can get information from other group who work in the same working area because like for example in one room they had about 7-8 group working at the same time so they can give their feedback. Supervisor can ask other group for example does my group member come to do works or something like that, so they can get information from other colleagues if they scared the group leader is unfair or so on.

Researcher : Yes, some of the group leader might protect his group mates or friends. That is a good idea. Any other improvement?

CS1S7: Hmmmm I can't think of other way because as leader they cannot observe their team member for 24 hours, so what we can do is other group member feedback because mostly they are working at the same time. Maybe lecturer can install CCTV in the lab, that is another option as an alternative for the lecturer observation.

Researcher : Ok, last two questions, you are nearly there to graduate, next month?

CS1S7: Yeah.

Researcher : What is your plan after graduate from ***?

CS1S7: I plan to further my study.

Researcher : Have you decide where to further?

CS1S7: I plan to further my study in Monash University, in Sunway Town. I plan to study there for a year.

Researcher : Only for a year?

CS1S7: Yes, because I have asked them, they said that we can transfer credit maximum for one year and I will study in Monash University in Malaysia for a year and last two years I will fly to Australia, for Monash University in Australia, because I have a relative there. And then for my others friends most of them they want to work, haaa they said I don't want to further study, I want to work, I want to find money like that. They said that hmmm…

Researcher : Can I know what motivate you to further study than working?

CS1S7: What motivate me to study... hmmm.. for reality is money.

Researcher : Money?

CS1S7: Yes, because now we study is to find... how to say ehh, most of them, we can ask most of the people why they study is to improve themselves. But mostly in reality they want to further study so that they can find more money. So like my friends said why we want to further study, I want to work now, find money and I said the salary is quite different between diploma and degree. They said that after you study degree I have already work for three to four years and mostly I can become how to say ehh get promoted and more experience, and then like that. I want to further study because I want to find more money and another reason because my mother also wants me to further study. She also gives me suggestion and convinces me yeah I should further study.

Researcher : Ok, how do you think the generic skills can help you in your career in the future?

CS1S7: Because mostly if we... when we working like we working aaa you are not going to work alone, like for example you are working in a company and then for an example if you are an engineer, you are surely being working in group, not working by yourself for sure we are going to face a lot of problems. So PBL is aaaa very good guide for you to solve problem in terms of you have the critical thinking skills, you have the communication skills, you can work in group. Because if you don't have these type or these criteria you cannot work, very hard to work in the surrounding except you are the boss. But for me if you become a boss, you also need to start from aaa the bottom except you are open your own company or whatsoever.

Researcher : Yes, but still if you want to open your company, you need to know some people and have the networking. Ok last question; we have talked about the active learning, the generic skills and its assessment and so on. Is there anything that you have missed out and you want to add some more?

CS1S7: No sir.

Researcher : Ok, thank you very much ***** for your time and information. I really appreciate your cooperation.

CS1S7: Your welcome sir.

C. Employer's Transcript

Interviewee Name: CS1E5

Date of Interview: 13th June, 2014

Time of Interview: 11.45 AM – 12.38 PM

Researcher : Good morning Mr ***.

CS1E5: Morning.

Researcher : First of all, I would like to thank you for agreed to be interviewed this morning. The interview would not take long, probably around 45 minutes to one-hour duration depends on your input. Before we start could you please verify your name, position in the company and the nature of business for your company?

CS1E5: Ok. My name is ***. I am a technical manager at ***. Basically *** is an automation and process specialist dealing with the process control.

Researcher : Can I know how long you have been working there?

CS1E5: Around I would say 15 years.

Researcher : That's long enough. Of course you have hired an engineer and technician, how do they perform in sense of their generic skills all this while?

CS1E5: I realised the standard is decreasing over the years after year 2010 that is one thing for sure. It is a cross a board.

Researcher : Why do you think it happened like that?

CS1E5: Maybe because the change or the evolution of the culture bringing up the child, they are different with the way we are brought up, the way we learn in school and all those things. It is a society evolution I would say and also part of it because of the globalization on the technological change very fast, every 3-6 months. Some of them just cannot cope with whatever you learn in the text book 6 months down the road are different.

Researcher : Before we go further, can you describe to me your requirement to become a technician and engineer in your company?

CS1E5: Basically they are hired to solve customer problems and requirements on process control implementation and maybe to troubleshoot existing process control system.

Researcher : That is for engineers?

CS1E5: For the engineers as well as the technician.

Researcher : How is the nature of their work, do they have to work with other group or company?

CS1E5: Yes, basically we are more involved in the software and the control side, at the same time they have to work with a person from the mechanical, civil, chemical and sometimes from an instrument supplier.

Researcher : It is sound interesting; can you elaborate more on your nature of business?

CS1E5: Basically for example we are involved in the infrastructure sector, we also involved in the chemical structure or chemical industry and then treatment industry and manufacturing industry. For example, in building automation project, we are doing projects in government infrastructure so a particular engineer or technician, he has to deal with people from consultancy side, from civil engineering side, from mechanical, electrical and structure side because all of these will contribute to how we control this infrastructure either buildings or facilities. Like for example if we are working in the manufacturing side, we need to collaborate whoever we are working with, first the customer must let us know their objectives. Secondly, you have to work with the operator what is the best comfort level they want to operate the new line or the enhance line and then you have to deal with maybe for example the production people what is the rate or those parameters and then you have to deal with QC people to know that what sort of quality tracing record that they need to build into our system. Sometimes you have to deal with IT people to come across what sort of report that we need to export to them and how they can access our system.

Researcher : It seems too many disciplines and a level for the engineer to cope with it isn't it?

CS1E5: Yes. That is the nature nowadays means the engineer must have a multitasking skill.

Researcher : You have been 15 years in this industry; you have seen the transition from one culture to another, from one era to another era, so how do you find the Engineering Education since 15 years ago?

CS1E5: 15 years ago we were taught to do that what we need to do base on what we learnt. Nowadays for example if you are Mechatronics engineer besides being know how to install the robot, how to operate the robot, all these things, you need to design the entire line and then at the same time you need to know how the process of the entire line. You need to know about the quality tracing ISO requirement, ISO manufacturing requirement and reporting system for the entire line because nowadays all the manufacturing they are talking about the traceability so whatever you learn in the textbook is only 10%, and the rest 90% you learn on the job.

Researcher : Yes, on experience.

CS1E5: Yes.

Researcher : Can I know how *** graduates or students react on that based on your observation?

CS1E5: I would say for the first 3 months and first 6 months it will be a culture shock to them. What happened is that they never thought that they need to have those extra skills means that built in them. They were thought that it is just a single tasking. Nowadays is more than that.

Researcher : Do you provide any kind of training before you let them go to the site or see the client or customer?

CS1E5: Dedicated training is not provided I would say any employer would not do that so you have to learn during the job so you either swim or sink (both of us laugh).

Researcher : But what about graduates from other institution?

CS1E5: If let say you are coming from this I would say traditional university right; in UK or even local government university, of course they are the one who suffer the most on the culture shock. If you are coming from an American based system, they will be able to adapt faster.

Researcher : And why is that?

CS1E5: Because the way they been taught is different, they used the problem based teaching and then most of the time they are think out of the box work around the solutions where else if you are coming from let say traditional way of graduating and all these things refer to the text books does not work nowadays. It doesn't work. There pros' and cons' I would say that way for those people from UK or Australia graduates, they have a very good fundamental but when comes to problem-solving and those kind of things, they are not as creative or innovative as the students come from American way of teaching.

Researcher : It is depending on your way of learning right?

CS1E5: Yes, and also person attitude.

Researcher : Can I know what do you mean by person attitude?

CS1E5: I would say he must love his job because if you love your job it means that you will find the initiatives to go and learn.

Researcher : Why I am asking this because most of the participant would say attitude is very important criteria to sustain your career. Ok, let me pose this question, during the job interview, how do you know the candidate has the right attitude that you wanted?

CS1E5: Normally we will observe, I mean nowadays academic qualification everyone more or less is at par already, to be honest.

Researcher : Yes, very true.

CS1E5: So we will normally employ someone who has gone through their internship with us because for the internship duration is about 3-6 months, we will able to evaluate how the person solves the problem on the given task.

Researcher : So you mean you will select your potential engineer with the one who join the internship in your company?

CS1E5: Yes, that is our preference. Those who walk in are actually our second choice.

Researcher : I see because you have time to observe them before give them the commitment.

CS1E5: Yes, I see them go and things like that.

Researcher : What are things that you are observing during their internship?

CS1E5: The level of the maturity I would say and then responsibility. Those that responsible and love engineering as their career will normally deliver the task that we are given to them.

Researcher : What else do you observe? Do you think the communication skill is one of the observation criteria?

CS1E5: Yes, because we are dealing with different branch of engineering and then we are also dealing with different level of interface so basically PR skill must be there.

Researcher : Is your technician and engineer working in group?

CS1E5: Of course nowadays it is always being in the group. Nowadays with the enhancement of the technology, we say that besides using email we utilised medium like a Skype - video call, WhatsApp, Facebook Messenger so we can monitor their progress from time to time. And then we are also having tools for remote monitoring or what means let say if your colleague is having trouble at site, he may not have a particular skill, he can just hook on online, get the open line for us and access remotely from Malaysia to help him. So this will minimise his pressure on site and means that allow him more time to interact with customer, work around the problem to meet customer objectives.

Researcher : I believed your customer is not only from Malaysia?

CS1E5: No, worldwide.

Researcher : Where other country you have business with?

CS1E5: Mainly in Indonesia.

Researcher : So for sure the engineer and technician need to be able to communicate with the local right?

CS1E5: Yes. Normally the junior engineer will be on site for exposure purpose. That is the only time they get to learn.

Researcher : But there will be someone who is going to monitor and supervise right?

CS1E5: Yes, they will normally work with senior engineer.

Researcher : How many engineers and technicians you have currently?

CS1E5: About 10.

Researcher : Are they engineers only?

CS1E5: All in one. Engineering team we are talking about around 8 persons. Yes, the other 2 are the admin.

Researcher : I see. Ok, now we are going to talk about your experience hiring the *** students. I am not sure whether you are aware or not that in 2010, *** has adopted PBL – Problem Based Learning as the training approach. Instead of teaching the technical PBL is said to be as one of the best way to develop the students' soft skills compare to the traditional way of learning. It is start with problem given by the lecturer, and then the students will need to find the suitable resources to find the solution. After certain duration the students will need to present and discuss their findings in a group to the whole class and lastly the lecturer will give the feedback on the topic of the discussion. So the question is how do you find the *** graduates before and after the transition, is there any improvement or difference?

CS1E5: I would say not so significant for the time being. Maybe it is still early stage, now is 2014, maybe the implementation will improve couple of years down the road and we can see the result. We won't see the result straight away.

Researcher : Maybe you can see improvement in sense their technical knowledge or maybe the communication skills or what?

CS1E5: O they are more creative means that seeing thing and saying things and contributing things from the way you and me seeing things but whether it works or not work is another kettle of fish, I would say. It is good where it opened up in a different perspective.

Researcher : When saying about the graduates' communication skills, what are the attributes that you are looking from employer perspective?

CS1E5: First they must identify the objectives to solve the problem because at the end of the day is about the delivery and then they don't sway away from the objectives. That is the key thing be able to see things from a lot of matrices and simplified the whole process of delivery.

Researcher : Do you do any regular discussion with your worker after they meet with the customer for example?

CS1E5: Every morning we have a meeting and I expect them to email us the progress if they happen to attend to site every evening so that overnight we can think about it to have a good discussion on tomorrow morning maybe we will come out with ABC solution instead of D. That is the way how we work nowadays. It is a group approach where everyone contributes a little bit here and there. At the end of the day you may find something out of it and solve the problem. Of course it is a learning process; yeah it's a learning process.

Researcher : How do you monitor the group work among themselves?

CS1E5: By emails, by things like WhatsApp and all those things.

Researcher : So what are the attributes that you are looking at as an indicator of a good teamwork?

CS1E5: Of course deliver on time (both of us laugh).

Researcher : Everyone said that.

CS1E5: So that I can send them the bills (again both of us laugh).

Researcher : Maybe you can elaborate more on the attributes for a good teamwork?

CS1E5: Of course if he can able to solve the problems internally and externally I would be happy to play golf but it takes a certain level of I would say competencies and maturity to be able to deliver so because nowadays the working environment is very complex, means that you are facing with a bureaucracy and red tapes. If you are happening to deal with the authority or maybe a vendor which give you a lot of problem or a customer who demands whatever there is out of contract, it is all about handling the situations. It must be there the negotiation skills. You will be surprised that someone that is not from an engineering background is better in doing so. The reason why is that they are not hands on; on job they have the macro perspective on what is going on, they are able to tell the engineer what to tackle. I had this experience in Laos. Form 5 graduate general manager able to tell the engineer which pump to fix, running at what pressure...

Researcher : Form 5 graduate?

CS1E5: Yes. Why? Because he is not into it, he sees things differently from outer ring.

Researcher : That's impressive. He's a Philippines?

CS1E5: No he's a Malaysian.

Researcher : Can you share with me your positive and negative experience when working with engineers?

CS1E5: Which engineers, *** engineer?

Researcher : Yes, *** engineer.

CS1E5: Ok, the positive things about *** engineer I mean if you are getting those top 20% they are, basically you spent less time explaining to them on the physical elements of what to use, what to deploy and all these things. They able to work independently. The setback is that they may not be exposed the basic fundamental of certain component and all those things. It is still lacking there but that one they can catch up on their own when they are free but most importantly is that they know what to deploy, what to choose and all these things. I am talking about things like components. If they know more or less half the battle won, people say. Of course if you are how should I say, if you are evaluating from those who are graduates from the traditional universities so basically you have to teach them. The biggest problem is that they have the fundamental but they don't see things in actual world, so they do not know which one to use, choose and all those things.

Researcher : Their imagination is different.

CS1E5: Yeah, the way they think is different, always they want everything to be perfect but at the end of the day he didn't realise everything is about cost saving and optimise the project fund and all these things.

Researcher : Yes, for a company they are more concern about profits.

CS1E5: Yes, money.

Researcher : That is about the technical skills of the graduates, what about their soft skills?

CS1E5: Soft skills I would say that certain graduates they are natural born PR person; you cannot deny that. Certain people they are just not willing to open their mouth; we have to slowly guide them along. Nothing much can be done.

Researcher : But you said you observing them during the internship. Is that all the criteria that you are looking at?

CS1E5: No, of course some of them are very good, if you are throw them a project file they will be able to come out from A to Z. You just give them previous project sample they are able to do everything, some just not able to find where to start. It is an extreme gap. I mean those who are not able to start most of the time I got to know that at the end of the graduation they are not doing the engineering at all. I don't know maybe because my company is a bit more put you in a real life. This is what you are going to get if you are an engineer for the rest of your life. Some of them if you are evaluating after their internship that they are not suitable they just quit engineering.

Researcher : That is the sad thing about it.

CS1E5: Yes.

Researcher : Can you share what are the things that Higher Education can be improved for the engineer; you know something that we can do to improve our graduates?

CS1E5: Basically first I would say that the fundamental must be there. Then secondly is the technology always change every 3-6 months, there must be willingness instil in the graduates, whatever you learnt in text books nowadays must be enhanced with whatever you learn outside the classroom. It is a continuous process as the technology change.

Researcher : True, what else?

CS1E5: And then of course PR skills nothing much we can do. It is a case by case basis.

Researcher : Based on whatever you have told me can I conclude that technical skills is much more important than the generic or soft skills?

CS1E5: Depends on level, when you first start work the technical skills are very important. When you have reached the managerial level, we are talking about soft skills, they will kick in, and that will be later part.

Researcher : So throughout the process they will learn and develop their skills.

CS1E5: Yes, hopefully (both of us laugh).

Researcher : Does your company evaluate your engineer for the appraisal or KPI for example?

CS1E5: Our KPI is very simple if we are given the dateline you have to deliver on time every time. That's all.

Researcher : As long you can perform the task...

CS1E5: Yes, yes. And of course less problem for me I guess. That is our KPI. I think it is applying to everyone. Whatever those form is just for the documentation purpose only, if you still didn't deliver on time, you are lousy engineer.

Researcher : Ok, say for example they have problem at site, to whom should they refer to?

CS1E5: Normally they will talk to the senior engineer first. If the senior engineer facing the problem, then it will come back to me. Because certain thing, sometimes problems are I would say it's a legacy problem. Whatever that is happened before year 2000 is not properly documented in textbook or even in the project documentations. Those are legacy problem that people in the engineering must live with it. They may not have the exposure so whoever have must be able to share their experience.

Researcher : How many teams do you have in the company?

CS1E5: Internally we have two teams, we just small company and then externally we do have several partnerships sometimes it can up to four parties that we work together.

Researcher : Two teams internally?

CS1E5: Yes, 4-5 teams externally.

Researcher : They are working well didn't they?

CS1E5: Yes, everyone has their own specialisation I would say.

Researcher : So you mean in order to become effective in a group work we must have identified each of the party capability and speciality?

CS1E5: Yes. You know what the guy can do, you just give them do what he is good at. No point of giving something that he cannot do. You are racing against time.

Researcher : I think that is the problem in Higher Education.

CS1E5: Yeah, because basically as the project manager you must be able to identify advantage and disadvantage, the strength and weakness of your team member. And then you should leverage and make good use of whatever resources that you have regardless on the manpower, money, tools or whatever. Then you must able to evaluate on your positioning. It is like weighing the war, you must know the battle.

Researcher : You need to know you're down line.

CS1E5: Yeah down line, up line and all those things.

Researcher : Any suggestion for the Higher Education for *** especially because you are one of the employer who have hired *** graduates before, so basically you know our approach and our students' weaknesses, maybe you can suggest us on how we can improve things maybe in sense of the curricular for example?

CS1E5: I am not sure about how is *** approach now; I do come to know that other places like UTAR, they do appoint a visiting engineer, so means that my colleague is a visiting engineer, every 3 months he will go over there and then have a round table talk maybe give a forum on the certain topics or latest development. Sometimes this is done voluntarily or you know they get paid but in all those forum and discussion students from relevant sectors of engineering will be invited into the lecturing hall and then they will be given the talks, presentation or something like that on the current development, so this is the way that they link up the real engineering with whatever facilities available or teaching environment I would say to make it more relevant so that the students can relate whatever they learn or whatever they apply.

Researcher : It can be as a motivation for the students as well isn't it?

CS1E5: Yes, yes. In these entire forum as usual it happened before people will pop up with funny questions and those things so we just give them an overview basically what is happening outside and something like that.

Researcher : The forum is only focusing on the students isn't it?

CS1E5: No, even the lecturers join the discussion because teaching staff is not a full time engineer or maybe they have already retired you know so they also in the round table talk.

Researcher : That is a good idea, because what we have now the equipment in our institution for example, it will not be up to date with the technology we have outside in the real world. That is why we still need the input from the industry and employer on this.

CS1E5: Yes, employer or maybe a customer for you to know what is the requirement, what has they deployed you know to solve current problems and requirement in the real world. And I also come to know that places like this; UTAR they have a special session just to teach the students the art of war, basically about strategizing how to do your work and all those things.

Researcher : You mean on the management?

CS1E5: Yes, on the management, special topic art of war. They learn from the book art of war. From there, that is why their students have a little bit of advantage in handling and managing situation, if they are able to digest whatever they have been taught. I have seen that, it's effective.

Researcher : How long is the forum lasts?

CS1E5: The forum is about half day event. There is a lot thing like that. Of course my colleague will be given the topic in advanced. He needs to prepare and he will bring along some for example like reference what have been done, some picture, some video, some documentation, some design for the student just to expose to them, ok this is how it has been done in the real world because what happen is that the lecturer their resources are very limited so instead of driving them further might as well you get help outside which is more relevant on what you are teaching.

Researcher : True.

CS1E5: In fact, we are working on a sealing process machine in Cameron Highland, we did two machine. The owner is actually what happen is that he looks for the lecturer to solve this problem, he bought the machine from China but it doesn't work and then he gets us to fix it up to local condition get it up and running. After that it was brought back to Cameron Highland to do the sealing on tomatoes and then it became a case study. So every now and then let's say for a particular subject that touches on the machine automation and all those things, there will be a site visit. They bring the entire student to Cameron Highland and see how the thing is process. That is problem-solving for me, you buy something that is not suitable with your condition, you innovate and solve it. For sure it is ongoing process. The students might give you different idea; they will try to solve it even better and those kinds of things. That is something that real life problem.

Researcher : Yes, authentic problem.

CS1E5: Yes, we have this kind of a how should I say... It's ok if the lecturer doesn't have engineering experience before as long as you collaborate with the industry, they are more than happy to share things. You just approach them; I can help you on the current problem, what are the current problem and those things. Its ok I think everyone is welcoming for this approach.

Researcher : More brain more idea you can get.

CS1E5: Yeah, yeah. And after all you know it doesn't involve a lot of money to learn problem-solving. That is what other people are doing outside. They have taken this initiative because sometimes it is very difficult to visualize the actual situation in the class.

Researcher : I think every 3 months is a good time to keep on updating what is the latest technology we have out there.

CS1E5: Haaa yes. It is not only involving process control for my line of business, they even inviting people from civil engineering as well to come and give a talk on the latest technology, requirement and all those thing.

Researcher : Amazing.

CS1E5: Like today, for example, I read the newspaper UTAR is inviting PROTON general manager to come to UTAR and give a talk and forum on Kanban Manufacturing.

Researcher : UTAR is private university right?

CS1E5: Yeah, but I think nowadays is ok. Let say you have a good relationship with the industry; they are willing to share their experience because what happen is that this company also looking for future employee.

Researcher : Yes, at the same time they can market their own company.

CS1E5: It is a free marketing right or maybe they get paid for coming. If you are lucky, maybe they are doing the R & D work, project or what so ever, and the students can get involved.

Researcher : That's very good idea.

CS1E5: Because nowadays just for your info, in Malaysia we are shortage of engineer basically.

Researcher : Are you sure? We have so many higher institutions, universities and you can see most of our graduates have their degree.

CS1E5: But how many at the end of the day become an engineer? Because by collaborating and exposure to the real world means that indirectly they enhance this problem-solving skills relevant to real application. And then that is also platform for your student to show to this potential employer. It is an opportunity for the students.

Researcher : Yes, at the same time we know what are the current problems for the current technology. We don't want to know about the previous technology.

CS1E5: No, no more.

Researcher : I think it is a good practice, seriously.

CS1E5: That is why in Germany it takes two years for the attachment or internship. If you work on the ground you like or not, you are there, you have to solve the problem unless you quit. But again at the end of the day, if the person signs up for engineering, he must love engineering. That is the basic evaluation of the attitude, if you don't like it there is no point staying there.

Researcher : True, because some students said they are being force by the parents, siblings and so on to become an engineer.

CS1E5: I found this very effectively means that if you have completed a certain level of the classroom, I would say education and all this thing, it is time to work on the ground. You can really impress the students and relate it to the real world.

Researcher : For me the employer is the end user for the students, that is why I think higher education needs to update whatever your requirement on the students to possess and to equip. My research is to design a mechanism for the higher education to update the industry requirement focusing on the generic or soft skills of the student.

CS1E5: Very easy you just observe from the feedback during the forum or discussion with external party. We will be able to know whether the students can continue to become an engineer or the other way. Because if the engineer fails to relate whatever you learn in textbook and so on, he cannot proceed further.

Researcher : So you think every 3 months to get the feedback from the industry and employer is the best duration?

CS1E5: Yes, for me. If the students are good they can learn everything basically in one month.

Researcher : Hmm most of the students cannot learn in one month.

CS1E5: No I mean top 20-30% of the students there is a willingness to learn extra. I have seen *** students able to do programming in the project but not many of them.

Researcher : Ok, frankly what I heard from most employers, they don't have problem much on the technical knowledge or skills for *** students, but they have problems on their soft skills on how to deal with the customer for example.

CS1E5: No I will say those employers are waiting on the greedy site. You don't throw junior to do all this PR work and all this thing. They should be guided by the senior engineer. Yes of course he must have certain PR skills but by age 20 something you cannot expect him talk to the customer as if he is 50s'. That is the line that we need to draw.

Researcher : So you say that they still have time to groom their skills after finding the job?

CS1E5: I would say the junior engineer will work with the senior engineer at least 6 months before they are allowing to turn on something. That is for my company, minimum 6 months.

Researcher : Ok, last but not least. We have talked about your company nature of business; you have suggested me on how to improve or develop the students' soft skills and so on. Is there anything that you have missed out during our discussion and you want to add some more?

CS1E5: I would say hmm *** students are those in the balance 60-70% need to improve their soft skills. That is very important especially when communicating using English. They should find a way to improve their English because everything is in English. If they are good in English, they can progress very fast.

Researcher : Yes, I would agree with you because most of the manuals, notes, books, videos and so on are in English medium.

CS1E5: Of course if they have second foreign language like German and all those things, it will help even faster. But basically the first hurdle is you must have reached certain level of English competency. How you see that, ask them to write the first report, their first assignment. If they can give you single page A4 report, yes basically they have reached certain competency on the English.

Researcher : But then don't you think writing and verbal is different things, you can see most people can write well but when they tried to communicate verbally...

CS1E5: That is not so important for junior engineer, when he already reach the senior engineer level, yes of course he must be able to talk but at junior level you must be able to describe your problem and solution in a single A4 paper, which is more important. The key thing is that if you are able to write in down on the paper; one page then probably you are able to explain to me, if you are not even to write it in a single page, how you are able to tell your boss that I am stuck (both of us laugh). I think this is the cause regardless from whether from ***, overseas or other local universities. They do have those fresh graduates, those are having problem writing the report explaining the situation, so we will have to spend time and tell them sometimes you must see who is your leader, is he a layman, is he an accountant or is he an operator or whatever so he must be able to tune your report according to your audience so that you can deliver your message correctly. The failure of the engineer in the report is they always thought everyone is understood on what they are saying. They forgot to put themselves in opposite shoes, start from there you know slowly progress to verbal and doing all other soft skills and those things.

Researcher : Yes, need to recognise your audience level of education.

CS1E5: Yes, your target audience that is more important. At the end of the day is all about the invoicing (both of us laugh).

Researcher : Ok. Thank you very much Mr *** for your time and contribution to my research. I really appreciate your effort.

CS1E5: My pleasure.

Appendix 6 – Example of Participants' Transcript from Case Study 2

A. Mentor's Transcript

Interviewee Name: **CS2M6**

Date of Interview: **5th August, 2014**

Time of Interview: **11.00 AM – 11.52 AM**

Researcher : Assalamualaikum Mr ***.

CS2M6 : Waalaikumusalam.

Researcher : First of all, I would like to thank you for this opportunity to interview you this morning. The interview will only take about 45 minutes to one-hour duration which depends on your input. Before we start further could you please verify back your name, explain a little bit about yourself and your position in this company?

CS2M6 : My name is ***. I have been working with Advance Pact for two years after graduated from SAP, but I only completed until diploma level have not reach advance diploma yet.

Researcher : Ok, so you have not experienced WBL?

CS2M6 : Yes, I have not. But before I became a mentor, I have attended pedagogy and WBL training, but it is very short course, just for 3 days only. I became a mentor since last year, to be precise after one year I am working here.

Researcher : How many mentees have you mentoring before?

CS2M6 : Just one, but previously there are few others mentee who have followed me when I am doing my work, so basically I know a little bit how their performance during WBL.

Researcher : Can you describe what did you learnt during the 3 days training?

CS2M6 : That is only for teaching training, they teach us the approach to teach the students.

Researcher : What about the WBL training?

CS2M6 : Not as details as the teaching training.

Researcher : Do you think 3 days of training is sufficient for you to know the way to approach and teach the students?

CS2M6 : Frankly I don't feel it is sufficient and practical to learn everything in 3 days. I guess I have not learnt completely what I suppose to know. Additionally, my background is in engineering, so I am not really sure exactly the best way to guide the WBL students. As I am aware, my responsibility is more or less to provide the opportunity for them to learn on technical work while at site and from my understanding I need to observe them performing the work at site for me to know that the students really understanding what I have taught them before.

Researcher : At the same time, I get to know that there are a few placement students from other institutions as well isn't it?

CS2M6 : Yes, there are a few from UTM, UTHM, UNIMAP and IKM.

Researcher : IKM? Are you sure?

CS2M6 : The one at Ledang, I can't remember what it is called.

Researcher : KKTM?

CS2M6 : Yes, KKTM (receptionist came in because he has received a phone call from the user – about 2 minutes).

Researcher : Ok, we stopped at the duration of pedagogy training.

CS2M6 : Yes, for me 3 days' duration is not enough for training. At least it must be one-week training to understand basic in teaching because no one has background in education. I think our management and *** should aware of that.

Researcher : Can you briefly describe what are the contents of the training?

CS2M6 : They explain regarding the syllabus and equipment that we need to expose to the WBL students, but how to teach and approach the students are very minimal exposure. It is very theoretical, no practical at all.

Researcher : Who is the trainer?

CS2M6 : They are specialist from AP not the outsider.

Researcher : Does the specialist have the educational background?

CS2M6 : That one I am not sure, but I doubt if they have.

Researcher : What about how to assess WBL students do you have training on that?

CS2M6 : No, not as far as I can remember because it is just 3 days training, you can't expect much but what I really know as a mentor, I just need to teach and guide them on the practical or hands-on, the specialist covers the theoretical part. At first I will let them to observe how I repair the equipment, but next time if we face the same problem, I would expect them to know and solve it as I have taught them before. I will observe the way they solve the problem, are they following my steps or not.

Researcher : Just to rephrase what you have described just now, first you will teach the steps, next if the same problem occurs; you will ask them to perform just like you have shown to them previously.

CS2M6 : Then I will observe critically the way they solve the problem, whether they can solve the problem by themselves or they still need others help. Usually after being trained for 6 -7 months, we can rely on them without our supervision at all. Some students -are fast learners, they just need 3 – 4 months to adapt and capture everything that we have taught them. They have no problem to solve small equipment faulty or whatsoever.

Researcher : I see, when we talk about the problem-solving right, how do you assess the students on the skills, what are the criteria that you are looking at?

CS2M6 : For me, I want to see their improvement, progressively maybe month by month. For example, first month they manage to solve problem at level one, perhaps after three months they can be at level two and so on. If I can see those improvements I will increase the marks compare to I have given them before.

Researcher : Means, you conducted progressive assessment.

CS2M6 : Yes, because we as a mentor will always be with them, so basically we can observe their weaknesses and strengths directly. Their skills, knowledge and experiences we can evaluate since they are working with me under one department of Dialysis.

Researcher : I see.

CS2M6 : I am responsible only for one machine, the dialysis unit.

Researcher : You mean you does not in charge with other equipment?

CS2M6 : No, there are others, but not so much. Basically it consists of general equipment like respirator, IBP and others. There has no big equipment like syringe pump, ventilator and so on.

Researcher : Is your mentee are taught only in dialysis equipment only or with other equipment as well?

CS2M6 : I have taught them everything but mainly on dialysis because we have to follow their syllabus and if you see the syllabus they need to cover most of the biomedical equipment available in the hospital. My practice is that, if they have covered the theoretical for one syllabus, I asked my mentee to follow respective mentor who is in charge on the equipment for that syllabus for one or two days. I assume the respective mentor will teach my mentee on the equipment that they have in charged with. I will assess my mentee in general because I don't know how my mentee has get along with other mentors, so I can only assess on what I can observe previously. How can I do that, is by asking him and test him whether he can catch up on what I have taught him before. But sometimes if I had time I will try to follow up on my mentee progress with other mentors.

Researcher : I see, and how you do that?

CS2M6 : For example, if I asked my mentee to follow other mentor, once he got back I will ask him what has he learn and also I will ask the respective mentor on my mentee progress, just to see whether the information that I have received match or not.

Researcher : Besides observation on students' problem-solving skills, do you observe their others soft skills?

CS2M6 : Yes, I do because normally we need to communicate with the users. For example, if I am on leave, I will follow up back with the users, so it is not only on my observation, I will refer to the users as well. I will ask the users whether they satisfied with the way my mentee dealing with them or not, managed to solve the problem or not, and so on. If the users praised the student that is mean the student has worked well because it is really hard to get user satisfaction. Once the user like the way you performing your work, your life is getting easier in the future.

Researcher : Who else will contribute to the students' assessment on verbal communication skills?

CS2M6 : Besides users, other mentors, staffs and sometime vendors.

Researcher : Is the assessment form provided or you just assess them without it?

CS2M6 : Yes, the assessment form is provided by ***. Usually end of the semester; they will distribute the assessment form.

Researcher : Can I know what are the criteria stated for the verbal communication skills in the form?

CS2M6 : There is no specific criterion; it just stated verbal communication skills as general.

Researcher : Ok if you compare WBL students with other placement students, how was their soft skills performance?

CS2M6 : For communication skills I guess they are in the same level, but in sense of their problem-solving, WBL students are far better because of the training duration is one year compare to other students who's their placement is only for 3 – 4 months only. For me the duration is not enough to gather all the information and experience. But somehow it depends on the individual themselves, some who are fast learners, 3-4 months they can catch up very well.

Researcher : Besides trained them on the technical skills, is there any training on their soft skills as well?

CS2M6 : No proper training on soft skills I suppose. In sense of the teamwork, I will observe on their willingness to help others, is it from their initiatives or they need someone to instruct them to help, the way they sharing their ideas and so on. For me, all these things are based on the individual attitude. If the willingness comes from their heart it will last long, but if we need to instruct them do this and that, it can only stay temporarily. They need to think like this, if you help people, people will help you back. The practice here is when someone doing their job, anyone who is free will comes and helps. That is the attitude we try to adapt to every student here.

Researcher : Ok back to the problem-solving assessment, I was wondering do you give marks if the problem can be solved or do you consider the process that have been taken to find the solution as well?

CS2M6 : I am more concerned on the process of finding the solutions, what are steps that have been taken, are they following the right procedures and so on. They might be lucky if in their first attempt they can solve the problem, but usually it is going to take some time and few possible solutions to solve it. I used to count how many ways they have considered and the duration taken to find the solutions before me giving those marks. Some students just try once, if it can solve the problem they don't know what to do next and they give up. Sometimes they will start asking everyone in the office. That is not the way we have practiced here. Usually girl students are the one who's behaved like this. Boy always have more plans of all things. They will try everything that they can think of, if the part is not available, they will modify, they are just different with the girls in that sense. I am not trying to be bias to the boys, but that is the real situation now and based on what I have seen and experienced. That is on technical, but if it comes to documentation the girls are ahead from the boys without any doubt (both of us laugh). The boys will try to get the simplest way to write which sometimes does not make sense because they think as long as he can understand that is what matter.

Researcher : You mentioned earlier that the students are needed to report to you what they have done when you are on leave or when you are not around. How do you find their ability to explain to what had happened during that time?

CS2M6 : My mentee name is Zul. Usually when I asked him what he has done, he is able to explain to me step by step in details. I noticed on WBL students one thing, if they can manage to repair the machine, they will be able to describe what they have done. You can know if they can't describe properly means that they didn't do anything.

Researcher : But don't you think some students are doing well in whatever they are doing but in sense of describing things are somehow hard for them?

CS2M6 : Yes, I am aware of that but I can say that WBL students, they can do and describe on things maybe because of our environment which acquire them to talk, explain and communicate with users, staffs, mentors and sometime vendor. Besides that, each of WBL students are required to make a presentation every morning in rotation basis, means one student for one day. Basically they need to explain one the machine that they wanted to share. This is one of the activities to train them on their verbal communication skills, which we think it helps to develop the students' confident to speak in front of the public. During the presentation, the staffs who have experienced with the machine will ask some questions, just to make sure they know what they are presenting and just to update what they don't know (someone calling his hand phone and he is picking it up – about 15 seconds).

Researcher : Does the presentation need to do only by WBL students?

CS2M6 : No, it is applicable to WBL and other placement students; diploma and degree, all the same.

Researcher : Do you inform them when will their turns?

CS2M6 : Yes, they have been informed so they need to prepare. After the presentation we will have Q & A session, we will pressure them until they can't answer the question. Usually the questions will come from the seniors who have been working with the machine for 4-5 years. The reason why we ask such difficult questions is to motivate them to do more research on the machine. They can either check through the internet, manuals or maybe ask from whom asked the question in the first place. Usually the senior staffs will guide them through until the students can get the clear picture about it.

Researcher : So you don't mind if your mentee asks or follow other mentors?

CS2M6 : I don't mind at all as long he informs me earlier because if anything happened know where to find him and it is easier for me to follow up with him and with the mentor that he is working with.

Researcher : In the early beginning of our conversation that you mentioned about all of the mentors does not have educational background, can you describe how do you feel when you know that you are require to teach the WBL students?

CS2M6 : For me I don't have problem with it, I will teach them on what I know but whether my approach or my way of teaching is suitable for them, I am not sure. Maybe my approach is not the same as they have expected or so on. So basically we as a mentor will try various ways to satisfy the students, if this way cannot work we will try other way until we know the best way to teach our mentees. Luckily they have allocated one mentee to one mentor, so it is much easier I guess. If I need to handle 3-4 mentees at the same time, it will be troublesome for me.

Researcher : Is there any inspection done either by AP or *** on your approach of teaching?

CS2M6 : No as far as I concern. But we do have DNO – Diagnostic and Observation where we test them on what they know about the equipment.

Researcher : Who runs the DNO?

CS2M6 : It is handled by the specialist. They will explain details about the machine and at the end of the DNO; the specialist will conduct a test. It is to verify the students' knowledge on the specific machine.

Researcher : But the DNO is basically on technical isn't it?

CS2M6 : Yes, technical and theory.

Researcher : What about their soft skills?

CS2M6 : No assessment at this time. Usually mentor who will assess them.

Researcher : I see. Ok since the soft skills assessment is based on mentors' observation, for sure you can't monitor them all the time, can you share how you manage your observation on your mentee?

CS2M6 : For me, I will refer to many peoples. Basically with whom my mentee has dealing with users, staffs, his colleagues and maybe vendors. How is his way of learning, the way he has communicated with them, I will ask everyone about him. I don't want the assessment coming from only my side; I need to consider others as well. It is to verify my judgement. We need to admit that we also have our blind spot, so others opinion and feedback is important to fill the gap where we can't see things. I will consider all the positives and negatives feedback from them. Before further actions can be done, I will ask him personally what has going on, is there any issue out there and so on. I will try to investigate why did he received negative feedback from the users for example. If it is my mentee fault, I will ask him to apologies. So far we have failed only one students, I am not sure whether he is WBL students or not. It is because he can't cope with other staff including his own mentor. He created his own gap with others as he prefers to work alone which is not acceptable in this company.

Researcher : Who will consult the students if they are problematic?

CS2M6 : Usually we will consult internally first, because we don't want to involve *** and AP management. Our priority is the students and their mentor. If the students' problem, mentor reputation will also be affected. We will consult and give them chance. If he is still like that, then we will involve the HR and AP management.

Researcher : How many mentors are now?

CS2M6 : It is based on the number of students. If follow the requirement, to become a mentor the staff need to work more than a year and basically all staffs are eligible to become a mentor. What has been applied here is every staff will be given an opportunity to mentoring the students.

Researcher : As you have experienced as a mentor for a year, have you heard or noticed by yourself any improvement on WBL students' soft skills?

CS2M6 : So far I have not noticed any improvement but this is what I heard from other mentors; the students nowadays are getting lazy to study, not willing to stay back after working hours and very calculative.

Researcher : I see.

CS2M6 : Previously when I did my placement during my diploma in Seremban Hospital, I have experienced staying overnight until the next morning and I don't make fuss about it. Nowadays I noticed that sharp at 5 pm, they are ready to punch out although they know their mentor still has work until 8 pm or 9 pm. My experience as a student during the placement, I don't dare to go back if my mentor is still at site. If I don't have the opportunity to do the work, I will sit quietly and observe how my mentor does his work. I learn through my mentor experience. I can see big different the way I have been taught with the students these days. They are not able to stay longer in the office especially after 5 pm.

Researcher : I see; I can feel your frustration.

CS2M6 : You know what, we can't even advise them, some more our age is not much different, gap between 2-3 years only. They feel like we are close friend already. I guess their respect towards the mentor is less. If I want to advise them, I need to do it indirectly. I try to maintain the relationship and try not to offend my mentee. I am noticed that the students have less respect with the elders, the way they communicate and interact, I can say not appropriate.

Researcher : Really?

CS2M6 : Yes, maybe one of the reasons because Melaka is their hometown. As we know people from Melaka, their language a bit rough. I easily get offended by the way they speak to me. But there is nothing much that I can do, that is their attitude and that is the way they being brought up, it is not their fault.

Researcher : Yes, you have got a point there. Ok, regarding the assessment, have you done any reflection or feedback after the assessment?

CS2M6 : Yes. Usually I will give marks from 1 to 5. I will consider hmmm..

Researcher : The marks allocated in a form of 1 – 5?

CS2M6 : Yes. 1 is very poor and 5 are very good. I never give my mentee 5; I think the maximum I have given is 4. Usually if I gave them 3 or 2 they will wonder why and they will ask me. But not all dare to ask, maybe one or two students brave to ask why. And most of them know what their mistake is and they feel they deserved the mark. For me I expected them to ask me, get a clarification with me, and not just make an assumption on why I give them such marks. I will not tell them if they are not asking about it. I want to see their initiative to ask if they really want to learn. If they have that kind of mentality, it is not good.

Researcher : Can you describe more on the format of the assessment?

CS2M6 : For example, the communication skills, there is 1 – 5. If I am not mistaken there are sub criteria under the communication skills, but I can't remember what they are. The assessment form I think you can get from Mr *** because he is head of mentor.

Researcher : What about the teamwork and problem-solving?

CS2M6 : Seriously I can't remember, but I am pretty sure they are included in the assessment.

Researcher : I get to know that in WBL, there is less group activity, can I know how do you assess the skills?

CS2M6 : Like I have mentioned previously, I gave one question or problem to them, then I want to see who will first react, how do they distribute the task, who is be able to instruct others and obey to it. Yes, there is less activity but we usually create the activity indirectly. Believe me from there you can see, who can be a leader, can recognise individual capability, how they solve the problem in a group.

Researcher : Can you elaborate more how do you allocate the marks to them, is it individually or everyone will get the same marks?

CS2M6 : Although it is teamwork marks, I will assess them individually. I am concern on their participation in a group; during discussion, troubleshooting, repairing and other group activity. I will try to identify who is the 'passenger' in that group. This type of student will not contribute idea and most of the time they become an observer, just look how their colleagues do their work.

Researcher : Are you in the same office with your mentee?

CS2M6 : Yes, I am. That is why sometimes I just let the pump or motor or other equipment on my table. I expect them come and ask me what wrong with the equipment, how they can help to repair it and so on. What I observed till now, if one of them are struggling to repair the equipment the rest will offer help and they learn together. This is the culture that we try to nurture in each of the students and also the workers.

Researcher : When the staffs practice it, indirectly it will motivate the students to adopt the culture.

CS2M6 : True, although the students haven't seen the equipment, they will surely ask anyone who knows about it. They will try to understand and know about the equipment. Alhamdulillah we have maintained the culture for so long.

Researcher : I have been told that in this hospital, there have about 4 departments; general, lab, critical care and dialysis.

CS2M6 : Actually there is more than that. In general, depart it consists of basic equipment; in critical care it has equipment such as ventilator, physiologic system and so on. There is also operation department, the equipment such as the table, saw, and drill and so on. We have 5 departments actually. In general department, it consists of several sub departments under it, same like other department.

Researcher : Which department are you in now?

CS2M6 : I am in charged with the equipment in Dialysis Department.

Researcher : I guess your mentee have learnt more on dialysis equipment rather than others?

CS2M6 : Yes, but I always make sure he learns from other mentor on other equipment as well. For example, if I know the syllabus what he will cover for the DNO at the end of this month, I will ask him to learn first, prepare some knowledge to ease the learning later on. If I am not mistaken WBL students will need to complete 6 or 7 syllabus during WBL prepared by *** and AP. Each of the syllabuses is focuses in one machine and is conducted by the machine specialist. Beforehand I will advise my mentee to follow other mentor to learn a little bit or basic about the machine. It is good to help better understanding during the DNO later.

Researcher : Are the students allowed to follow other staff besides the mentors?

CS2M6 : Yes, they are, we didn't restrict them as long the purpose is to learn. I want to see the outcome what they have learn at the end of the day.

Researcher : How do you assess them if that is the case?

CS2M6 : The assessment like I said is done when their lecturer comes to visit. But my evaluation is based on daily observation. If my mentee follows other staffs or mentor, I will make sure before he's clock out from work, I ask him what he has learnt today. Why do you need to do that? What do you understand with it? Can you apply the same procedure with different machine? And so on. If he managed to explain to me briefly, I will just keep quiet and then I will refer to the mentor or staff that he has followed to verify his explanation. Besides my observation, marks are given based on that matter as well. Sometimes I let him go to the site by himself, try to repair alone. In that case I will ask users to verify how is my mentee interacts with them, did he ask for your permission before he do his work, did he explain what he is going to do and so on. Basically for me, it will indicate how well my mentee negotiation skills with the users.

Researcher : Yes, true.

CS2M6 : The nature of our work is started by users request or report the faulty of the machine, we need to respond, suggest what are the procedures will be taken to the users and they will decide whether or not we can proceed with the work because users have the right to stop us. It has stated in our agreement.

Researcher : Besides repairing, what other activities the students need to perform?

CS2M6 : Besides repairing we expect the students be able to conduct the preventive maintenance work. For example, every 6 months, we need to service the dialysis machine.

Researcher : How many equipment are AP in charge in this hospital?

CS2M6 : In dialysis department only, it has about 35 dialysis machines not including the small's equipment. For general department, because my colleague who is in charge for it just sitting beside me, so I know his workload. Every month, he has about 400-500 machines to be maintained and serviced.

Researcher : Wow, that's a lot.

CS2M6 : The job involved with calibration as well. He needs to perform alone. But usually other staffs will offer their help if they are free. Although my number of machine sounds 35 only, but the time requires performing the maintenance is longer because most of the machine are old. I can say they are more than 10 years' machine, so you can expect there are faulty here and there, leaking and so on.

Researcher : In a good point, it is an opportunity for the students to learn isn't it?

CS2M6 : Yes, it is. They can gain a lot of experience and knowledge if they can manage to perform the procedures and know how to repair the equipment. Usually every 3 years the hospital will purchase new equipment, to finish their budget. If it is new equipment we don't have to do anything because it is still under warranty. The vendor will responsible to take care of the equipment. When they perform the service or whatsoever, we need to be there. Although it is not compulsory for us to help the vendor, this is the chance for me as a staff and the students to learn something new with the vendor. Some vendors are reluctant to teach us, because that is their business, I don't blame them.

Researcher : That is their company income.

CS2M6 : Yes, but you need to aware that the vendor will try to sell and charge us more because that is their profit, but for us we will try to minimise the cost because that is our profit. Everyone will try to maximise their profits. That's business.

Researcher : That is good practice I would say. As a staff you are aware how to generate income to the company.

CS2M6 : All the staffs here aware of that because our salary, increment and bonus are depending on that (both of us laugh). If it is not necessary to change new part, we can always modify it, this would minimise our repairing cost. There are hospitals who really particular on the budget like this hospital (both of us laugh). Before this I am working Tuanku Jaafar Hospital in Seremban, the director is very good, whatever we think is time to replace he has got no objection as long the equipment is well prepared.

Researcher : Back to WBL process, can I know who design the syllabuses for WBL?

CS2M6 : I am not sure about that but I guess *** designed the syllabuses with AP's help. To conduct the syllabus AP is in charged on that. Maybe you can refer to Mr *** or Mr ***.

Researcher : Ok Mr ***, you have share your experience working here, the way you conducting the WBL, how do you assessed the students' generic skills; their verbal communication skills, teamwork and problem-solving. Throughout our conversation do you have anything that you have missed out and you want to add some more?

CS2M6 : I think that's all. I have shared everything I guess. It is just that I would like to suggest the pedagogy course should be conducted longer, how I should say this, not longer. If it is 3 days' course but if it is compact and full of information with a qualify person, I guess it would be much better. I know I am lacked with the teaching skill that is why I used to refer to my seniors on matters which involve with the WBL students.

Researcher : That is good initiative from you because some mentor or lecturer just follows their own way.

CS2M6 : No, I guess it will not be fair to the students. For me I need to teach them on what they need to know by end of this WBL. Whatever it is, discipline is critically important, I don't care whether he is stupid or a slow learner, as long he is willing to learn, coming to the office on time, show the interest to learn, I willing to share. I don't mind if he asks me ten times on the same question as long he is discipline with me and his work. I don't like people who pretend to know something and actually they didn't know. That is why once I have taught him/her something I will ask questions at the end just to verify he/she has acquired the knowledge.

Researcher : I think you have got a good approach there. Is there anything else you want to add?

CS2M6 : That’s all for now.

Researcher : Ok. Thank you very much Mr *** for your time and sharing your experience with. I really appreciate your input.

CS2M6 : My pleasure.

B. Student’s Transcript

Interviewee Name: CS2S3

Date of Interview: 23rd July, 2014

Time of Interview: 10.00 AM – 10.46 AM

Researcher : Assalamualaikum ***.

CS2S3: Waalaikumusalam.

Researcher : First of all, I would like to thank you for agreed to be interview this morning. The interview would not take long, probably around 45 minutes to 1-hour duration which depends on your input. Before we discuss further, could you please verify again your name and brief a little bit about your background?

CS2S3: My name is ***. My hometown is in Banting, Selangor. Before this I completed my diploma in Electronic Engineering at ***. Currently I am furthering my Advance Diploma in Bio-Medical Electronic Engineering in the same polytechnic.

Researcher : What is your secondary school name?

CS2S3 : Wan Saodah Islamic Secondary School in Banting, Selangor.

Researcher : Ok, can I know why from Islamic secondary school student, you decided to become an engineering student?

CS2S3: Hmm how to describe this, I applied several places for me to further my study, that was the only offer that I get. For your information, after MCE I worked for more than a year.

Researcher : What work have you done?

CS2S3: I worked as a government contract support worker. I applied to further my study since then. Actually I received two offers; from UITM and polytechnic. I did ask few people on which offer I should accept, most of them preferred me to accept offer from polytechnic since they know I am more to hands-on, not a ‘theory’ type of person because I admit that I am a little bit ‘slow’.

Researcher : During applying a place to further your study, is engineering your first choice?

CS2S3: No, in secondary school I am taking the Art stream. My first choice was to further in Islamic Banking. If I am not mistaken Electronic Engineering was my second or third choice. When the offer came, it was the Diploma in Electronic Engineering that is why I just accept the offer. Furthermore, I feel tired of working and that is why I decided to further my study.

Researcher : What about parents and siblings, do they encourage you to take engineering?

CS2S3: No sir, they don’t.

Researcher : I would like you to refresh back your mind when you are in the secondary school, what is the difference that you have experienced in sense of your learning in the secondary school and in the polytechnic?

CS2S3: In secondary school, the concern is more to exam oriented which basically we learn through the notes that has been given by the teacher whilst in polytechnic, the lecturer taught us the practical and theory of the topic/subject which make us easily to understand. For example, we learn about the electronic circuit; the diode, how the current flows through it, it helps us to imagine how the diode works. The lecturer explains a general view about the topic and then we need to do it by our self; how to assemble, how the signal flows and so on. We can get at least the rough picture about the topic.

Researcher : In polytechnic, does the lecturer teach you on the theory like you have during the secondary school?

CS2S3: Yes, the lecturer explained to us a little bit about the component since most of the students' backgrounds are not technical or science stream. Once they have explained the theory, we need to perform the practical in the lab. Usually the practical session will take about 3 hours to complete, in that time we need to perform several procedures. If we don't understand, we can always ask the lecturer. The lecturers usually will not answer directly our question; they will give a hint or guidance for us to understand the problem or topic by ourselves. They will never give a direct solution or information to us.

Researcher : Can you describe to me how do you feel when you first study engineering in polytechnic since your background was in Art stream?

CS2S3: I don't know how to describe, because I have worked for more than one year, I don't feel anything.

Researcher : Your job that time was not in engineering right?

CS2S3: No. It is not relevant. I also have forgotten what I have learnt during the secondary school because I have worked for quite some times. I just felt curious that time whether or not I can study again since I left education for nearly two years. My MCE result was not that good. Me, myself, I am also not sure if I can study again or not. I always ask my colleagues at work on their opinion and suggestion; what should I do and so on.

Researcher : When do you start to like engineering?

CS2S3: When I start study in polytechnic (he laughs). Actually my intention furthering study at first is to gain the qualification only, so does not matter which discipline. At first I am quite afraid to learn engineering mathematics and electronics subjects, something that I never learn before. I slowly develop my confidence and passion towards engineering.

Researcher : So how do you feel now?

CS2S3: (He laughs) Not too bad, so far so good.

Researcher : Ok, we move on the next question. You have completed your diploma in *** and currently you are furthering your advance diploma in the same polytechnic. Is it in the same course?

CS2S3: During diploma I have taken Electronic Engineering but currently I am taking Bio-Medical Engineering.

Researcher : I get to know that during advance diploma programme, the first two semesters you have learnt in polytechnic, whilst last two semesters in the industry which is call Work-Based Learning (WBL). When you first undergone the WBL, does the polytechnic provide you any kind of training regarding the WBL process?

CS2S3: Yes, they have provided an introduction course on WBL. In the course, they explain the company (industry) background, what they expect the students do in the industry, introduction to several equipment that will be commonly used and so on.

Researcher : So they have explained what are the WBL processes?

CS2S3: Yes, they did; how long is the WBL process. The company representative has also briefed the students regarding the WBL process.

Researcher : Can I know personally, what is WBL to you?

CS2S3: It is Work-Based Learning. We learn from what we do during the work. If we learn through theory, sometimes it's quite difficult for us to imagine and understand. For example, when we dismantle and assemble the equipment, and troubleshoot the problem, we can learn more things easily. Previously my soldering skills are not so good, but since I attend WBL, the environment itself requires me to troubleshoot and repair electronic board, hence increase my soldering skills. Before WBL, I have exposed to more theory; basic components and boards which has less troubleshooting opportunity. In WBL we need to identify where the fault come from, verify the faulty component and so on. The students need to be able to solve the problem. All of them I learn from WBL.

Researcher : Is that the difference on the learning approach between first two semesters with the last two semesters?

CS2S3: First two semesters, we learn the theoretical about the medical like anatomy and so on. We do have lab, but not so extensive in WBL because the equipment is not faulty, so we don't learn how to troubleshoot. We just learn what are the equipment and electronic board functionality, and so on. For the last two semesters, in WBL we learn more on troubleshooting the problem or faulty of the equipment.

Researcher : Yes, I can understand you, more equipment faulty that you need to repair. You learn during the process.

CS2S3: True, I learn a lot. It is good for me.

Researcher : Just want clarify from you, first two semesters there is no WBL at all?

CS2S3 : No, just concentrate on theories and a few lab works, I can say it is less.

Researcher : How the lecturers teach during that time?

CS2S3: As usual, the lecturer will explain a bit about the topics and having a discussion throughout the subject. It also consists of presentation, group assignment and so on. We are exposed to medical, hmm not really purely medical, for example if the patient has this kind of sickness, what is the machine that can be used to help the doctor to diagnose or to help the patient throughout the treatment.

Researcher : O you are not only learning about the instrument or equipment; you also need to learn about the sickness or disease of the patient?

CS2S3: Yes, what is the sickness, the cause, what is the appropriate equipment will be used and many others. From zero knowledge, now I can say I have learned a lot.

Researcher : So you think WBL is a good approach of learning?

CS2S3: Yes, absolutely good. As I have mentioned earlier, I am not good in theory, you know boys don't like to read that much (both of us laugh). We prefer to learn through practical work. It suits me well.

Researcher : Yes, there are many ways of learning, whether by doing, listening, looking, reading and so on. You are one of the learners by doing.

CS2S3: For me if I just learn the theory without the practical or touch the equipment, it is hard for me to imagine and get to know better. Like in WBL, the jobs require us to handle the equipment personally, one to one; it is advantage for me.

Researcher : When you first start WBL, how long it takes you to settle down in the process?

CS2S3: I don't have problem to adapt with the environment. I think during first week of WBL I have make use with the environment.

Researcher : Can you describe to me how is WBL work?

CS2S3: We do what the staffs do. First the user will send a request to AP if any equipment faulty. The staffs need to response on the request, go to the site, find the faulty equipment, ask the user what is the problem, how it is happen before the equipment faulty. It is important to know what is going on before the equipment faulty, to guide us where to start. It is also to verify the faulty from the user and from there we will start to troubleshoot the equipment.

Researcher : Do you usually troubleshoot on site?

CS2S3: In my case, I am in charge in Dialysis section; usually I do on site because the equipment is very big. Unless like the ECG unit or the aspirator, if we cannot repair on site, we will bring it back to the workshop. I am more comfortable repairing at site because it is hard to bring the equipment back and some more it will look messy. If possible I will settle the problem at site. If not, I need to request from the users for the equipment to be taken out from their place.

Researcher : Who are the users?

CS2S3: Users are doctors, staff nurses and sisters. Mostly these are the staffs whose are using the equipment. If the equipment faulty they are the one who will issue the request.

Researcher : I get to know that, during response to the request, mentor and mentee need to work together at site. When you first experience response to the request, who ask the user and perform the troubleshooting?

CS2S3: At first the mentor performs the job. He explains what will be the process, procedures and so on. If we faced 2-3 times the same problem, we know already what is the cause and how to repair it. That time the mentor will ask me to perform the procedure and he will observe while I am doing the task. If I do wrong, the mentor will guide me.

Researcher : So far have you managed to solve or repair all the faulty equipment?

CS2S3: So far I have managed to solve all. If we cannot solve the problem, we will call the AP specialist and other seniors to help us. If still cannot solve, then we call the vendor to step in.

Researcher : In WBL, do you need to do any presentation?

CS2S3: Yes, in WBL, we have a few class of multiple subjects, presentation, test and quiz. The classes are conducted for the introduction to the equipment for example X-Ray, patient monitor and so on. They will refresh back our knowledge.

Researcher : Who design the test or quiz?

CS2S3: I think the AP personnel who are in charge to design the test. In WBL polytechnic staff just being as an outsider; observe the students' progress and WBL process. WBL processes are fully handled by AP personnel. Every Friday I need to present what I have learnt for last week; it is like a progress presentation. At the end of Semester 3, we need to choose one equipment with a different brand/model and present the advantages and disadvantages for each model. In this semester which is the last semester, the presentation is called 'Engineering Improvement' where it requires us to improve current equipment for better use in the future.

Researcher : In my experience, when we ask students to do presentation, they will reluctant to make the presentation. What about yourself?

CS2S3: I don't feel reluctant; it is just sometimes the time constraint, because I have so many works to settle, need to prepare the slides and everything. I don't have problem doing the presentation because for me by doing presentation it can build up my confidence level. Personally I am not confident to talk or present in front of many people but if I need to present frequently, I think it can help to increase my confident level.

Researcher : So do you think WBL has helped you to increase your confidence level during the presentation?

CS2S3: Yes, I think I have improved my presentation skills because previously I just present in front of my classmates and lecturers. In WBL, we need to present in front of all the staffs.

Researcher : The presentation is in English or Malay?

CS2S3 : Must be fully English.

Researcher : Do you have problem speaking in English language?

CS2S3: So far I survive (both of us laugh).

Researcher : Ok, presentation is one of the verbal communication skills. As you have mentioned earlier that you need also to communicate with the users, vendors, mentors and other staffs, do you faced any difficulties when communicating with them?

CS2S3: At first I can feel that they are not confident with me, because I am still new. Last time when I want to get the close signature from the sisters, she does not want to sign. But now when they look how I have performed they feel confident with me. For me, I need to establish and maintain good relationship with the user, convince them that we can do the work.

Researcher : Can I know how the mentor assesses your verbal communication skills?

CS2S3: I guess the assessment is more on mentor observation at site. Sometimes the doctor also asks about the equipment, so we need to know how to answer their question technically. Same it goes when other users ask; staff nurse and sister. We also need to establish relationship with the patient as well. I think that is how they assess the skills.

Researcher : You think? You are not sure about it?

CS2S3: No, what I meant is I am sure about it. When there are many equipment's faulty, it creates tense to the user, then they will pressure us to repair it as soon as possible. That time it will really test us on how to handle the situation; of course we cannot mad with the users, we must know how to calm them down. Not only that, we must calm our self as well. I have experienced many times in that situation, but what to do, just smile and go on with our work. If it's involved with major repairing work, for sure it is going to take longer time, so we need to kindly explain to the user. Sometimes it requires me to talk to the specialist through telephone, brief them and if still cannot solve ask them to come at site.

Researcher : Is there any backup equipment available?

CS2S3: From what I know and have experienced in haemodialysis section, we don't have backup equipment. Dialysis patient will have their treatment every 3 weeks, usually the peak days will be on Monday, Friday and Saturday. For Tuesday and Wednesday, if the equipment is faulty, we can still swap with others which are available. Sometimes in ICU, we have 4 patients at one time, that's a lot. Staffs working in ICU are always under pressure. Good thing about it I can learn a lot of things.

Researcher : Are you only learned in haemodialysis section? What about other places?

CS2S3: I do learn in other section as well.

Researcher : Is it something like a rotational basis?

CS2S3: I in charge for haemodialysis in Ward C, Ward D and Ward E. All of the wards consist of ECG, aspirator, basic or general equipment. I need to take care of them as well. For me, I am more confidence to repair haemodialysis equipment.

Researcher : Yes, it is good to master at least one of the equipment.

CS2S3: True, it is impossible for me to master all other equipment because of the time constraint.

Researcher : Ok, back to my question regarding the verbal communication skills, does the mentor inform you the time that he/she want to assess?

CS2S3: No, it is based on mentor observation throughout the WBL. Lecturer in polytechnic provides us the form and asks the mentor to fill in the form. I never asked my mentor the criteria and how many marks I got. I trust on their judgement on my performance and accept the given marks.

Researcher : But have you ever experienced the mentor clarify the assessment criteria for verbal communication skills?

CS2S3: They did not tell me what are the criteria; I guess it is based on their observation on me. My mentor used to advise me to make a good relationship with the users, perform well in every job so that the user will have confident on us. How mad the user towards us, keep smiling at user (both of us laugh), do not ever show our dissatisfaction in front of the user.

Researcher : Ok, we have talked about the communication skills, besides working with mentor; do you need to work in a group/team with others?

CS2S3: Yes, especially during the initial stage of WBL, my mentor encourages me to follow and help other mentors as well to expose me with other environment and basic equipment. I learned the ventilator in operation theatre, depends on us what we want to learn. The objective is to get to know as much equipment as we can. My mentor doesn't have problem if I follow other mentors as long as I inform him.

Researcher : Do you find any difficulties working in a group?

CS2S3 : For me working in team is better than working alone.

Researcher : Can I know why you say that?

CS2S3: It is because we can generate more idea, and if we are alone to solve the problem, we will feel the pressure, when we are working in a team we can help each other, we can still make fun of it to release our tension. We can also discuss and sharing ideas, that is why I think work in team is better. When we work alone, sometimes simple things also we can think of the solution because we are under pressure, can't think straight.

Researcher : Have you experience having a group mate who does not do their work, just become a passenger in the group?

CS2S3: So far, I don't have that kind of experience. Usually we are given a group assignment; we divide the task equally, maybe one in charge in the programming, one responsible to find the information through the internet, the other one do the typing. Everyone will have their own task.

Researcher : Can I know how is the process of dividing the team mates?

CS2S3: For me I don't really mind if they want to select themselves. If they don't know what are their tasks; I will instruct them on what to do. I don't have issues on that matter.

Researcher : How is the assessment been done for the teamwork?

CS2S3: There is one of my group members do not contribute at all, we have to let our mentor knows about it. At first we try to consult with him, asked him to do his part and so on. But still he did not do his work, once or twice is ok for us but if more than that we can't help him much, so we just inform the mentor the truth and ask the supervisor to swap different group member or what. Usually the mentor will try to adjust and help to solve the issue. Say for example group assignment of 4 members, say the marks for the assignment is 80%, the mentor will not let us know the individual mark for the teamwork.

Researcher : Besides mentor observation, are there any other ways of assessing the teamwork skills?

CS2S3: I think the mentor assess the skills during the presentation as well. Usually the mentor will give very big task or assignment to the group, and we realise that the task is impossible if we want to do it alone so we need to divide the task in order to solve it. Sometimes the mentor will divide the task in the group; sometimes we can divide by ourselves because we know best who we can work with.

Researcher : We have discussed about verbal communication and group work skills; can I know how do you develop your problem-solving skills in WBL environment?

CS2S3: Problem-solving?

Researcher : Yes.

CS2S3: I usually look at what the error number pop up at the screen, if the error number is new which I have not experience with, I will refer to the manual. In the manual booklet, it will list out all the errors that we might possibly found on the equipment, so we check on that.

Researcher : Is it command to have error message if the equipment is faulty?

CS2S3: For haemodialysis equipment yes it will appear the error code. For example, the flow alarm, sometimes it happens because of the low water pressure, or low conductivity or so on. So we will investigate what are related to the flow. Usually the mentor will guide us on the procedure if the fault is new to us, what are the steps taken if this kind of faulty and so on.

Researcher : Since you have been experienced WBL for two semesters already, if I ask you to advice your junior on steps taken if any problem or faulty happen, what will be your advice?

CS2S3: I will explain to them based on my experience and how my mentor teaches me. First identify the error message or code, sometimes it just need your common sense for example the water cannot goes in, for sure you will trace where the water inlet, check the tubing and so on. The junior students need to understand the machine process, before they can do the troubleshooting.

Researcher : You mean how the machine operates?

CS2S3: Yes. They also need to think of possible solution with respect to that faulty, sometimes like I said it requires of our logical thinking. If it is just a common problem, then it is easy. If we refer to the manual booklet, it only stated what is the faulty or which area has faulty but it does state the solution on what to do. At least it helps us to scope in a small or particular area of the problem. In solving the problem, it requires me to always think on the solution. It also helps me to develop my troubleshooting skills.

Researcher : Do you always refer to the manual booklet only for the information?

CS2S3: Not only the manual booklet, I refer to the internet as well because sometimes the manual is not available in the office, so I have to download from the internet. I find old manual book sometimes might useful from new one because it more complete.

Researcher : Is the internet facilities provided in the office?

CS2S3: It is available; it is just sometimes if I am at site, I used my own data package.

Researcher : Does AP provide library facilities in the office?

CS2S3: No, they don't. If they have, I don't think I have time to go (both of us laugh). I have so many works to do. If I can't manage to solve it, I will call the specialist. Usually the specialist will guide us through phone on what to do because they have more experiences. They will ask us to check on few things before we do anything. Maybe during checking we can see what is the faulty. If confirm the faulty, the specialist will guide us what to do. Troubleshooting process can take about 2-3 days depend on the faulty.

Researcher : What tools do you usually use to troubleshoot?

CS2S3: Normal tools; like multi-meter, screwdriver, spanner and others.

Researcher : It does not require any special tools to troubleshoot?

CS2S3: Yes, sometimes we need to use the calibration tools and special spanner set.

Researcher : Where did you do the calibration?

CS2S3 : At site.

Researcher : Wow, you have the calibrator equipment?

CS2S3: Yes. Actually from the equipment itself can do the calibration. We just set to auto-calibration. Sometimes we need to calibrate manually, so it depends.

Researcher : Hmm how is the problem-solving assessment done in WBL?

CS2S3: I guess mentor gives the mark based on the process of finding the solution, in long term not just the outcome or solution because there are many problems need to solve. Sometimes when that happens I will separate with my mentor, he handles one equipment and I handle the other one. After I manage to repair or find the solution I need to report to him on what had happened, how I manage to solve the problem maybe that will contribute to my problem-solving skills mark.

Researcher : Does the mentor provide feedback if they see your weakness or you lack with something?

CS2S3: The common word come from my mentor "Creative... Creative...". We need to be creative if we want to solve the problem. Sometimes when repairing, we need to wait for a longer time for the parts to be available, so we modified the faulty parts. It really needs us to think more and creative on how to solve the problem with the limited parts/tools. Every day we are not facing with the same problem, there will always new problem to solve, I can say every week I will learn something new.

Researcher : How do you record your job task?

CS2S3: We have our logbook where we need to write down what we have done daily, so I record all the procedures in the book. It is very important because I easily forget what I have done previously so I use the book as my reference. Especially during the calibration, there are many things that I have done, I can't memorise them all.

Researcher : We have talked about three soft skills assessment, if I give you a chance to improve the assessment, what would it be?

CS2S3: For me if the mentor wants to give the soft skills mark, besides his/her observation maybe they can ask the user how we perform in sense of our verbal communication skills with them. In sense of the problem-solving, I think if the error came out mentor will ask me what I shall do next, if we can answer all the questions well, maybe he/she can give us mark from there. They just follow up what to do next and so on.

Researcher : Yes, question and answer session.

CS2S3: During our weekly presentation, after the presentation, we will open to the floor to ask us any question.

Researcher : Really?

CS2S3: Usually the presentation will handle by three personnel; one of them is the specialist so he will comment, condemn and ask the question, so we need to be able to answer the question. Their knowledge is very high so the questions will cover all aspects. The good thing if we cannot answer, he will explain or gives a constructive feedback but before that he will ask us to think first. Sometimes if we cannot answer the question this week, he will ask us to prepare the answer and tell him on the next week. Basically he gives us a room to find the information either from the internet or asking the mentors.

Researcher : Ok last two questions. How do you see yourself in a couple of years' time?

CS2S3: Frankly I don't like to study, I further my advance diploma because it is involving with more practical especially during WBL. Therefore, if I want to further my degree I would consider part time study.

Researcher : What about your career, are you going to stay in the same discipline?

CS2S3: I think I still young, I want to find other experience in other places. I need to stabilise my financial and my life. I will try to find better job and opportunity to improve my life.

Researcher : Advance Pact usually will recruit WBL students only as their worker or will consider other students from other institution as well?

CS2S3: I am actually has been appointed as a contract worker since a year ago.

Researcher : Can you describe what is contract worker?

CS2S3: My dedicated mentor has resigned so AP appointed me to replace his place. I am a worker as well as a student at the same time.

Researcher : So do you get the salary?

CS2S3: Yes, I do. It is actually teaching me on the time management because I need to allocate time to present and write the report at the same time I need to work like other staffs; troubleshoot, filling the form and so on.

Researcher : How does AP select the contract worker?

CS2S3: The only person who can do haemodialysis was my late mentor, before he resigned I am the one who follow him, so I know most of the equipment in the haemodialysis. When my late mentor leaves, they appointed me to replace his place so that they don't have to train external or new employee. That is how they selected me.

Researcher : How long the contract last?

CS2S3: Every 3 months, but they said that they will hire me until I finish my study. After I graduated, they will see how, most probably they will continue hiring me.

Researcher : Besides AP, what other company have the same background?

CS2S3: Faber and Radicare, they are just like Advance Pact but Radicare will only cover central of Malaysia; like KL, Selangor, Kelantan, Pahang and Terengganu. Faber Group will cover the Northern of Malaysia; from Perak to Perlis. Advance Pact cover the Southern; from Negeri Sembilan, Melaka and Johor.

Researcher : How many of you appointed as a contract worker?

CS2S3: Suhaimi is also a contract worker because his mentor on maternity leaves, so he replaces his mentor for about two months.

Researcher : What do you think of advantages of WBL?

CS2S3: The advantages for me, it helps me to develop my troubleshooting skills. During the initial stage of WBL, I am not confident to troubleshoot the equipment, not only troubleshoot, to open the equipment also I don't feel confident. Now, I feel comfortable even if at my house the fan is broken, I can simply troubleshoot. Previously I don't know what to do. So it is a good exposure for me to learn and make use with the environment. One more thing it develops my creativity in modifying the parts. Basically most of the equipment is very old, sometimes the parts have already obsolete so we need to modify.

Researcher : That is about technical skills right? In sense of the soft skills, what are the advantages?

CS2S3: I think about the communication skills. I feel more confident to talk with the users, not only staff nurse and sisters, sometime doctors as well. I need to be prepared all the time if they ask any question regarding the equipment. I need to discuss also with the seniors or specialist, sometimes I can do the repairing job by phone, and they guide me through. It is a new thing that I have learned.

Researcher : Ok what about the disadvantages of WBL?

CS2S3: For me the students allowance is too low.

Researcher : But you receive salary monthly right plus the student allowance?

CS2S3 : I only receive the salary; I don't get the allowance anymore.

Researcher : O before this the allowance is given by AP as well?

CS2S3: Yes, that is why for me I think the allowance is too low because previously when I am doing my placement during diploma, my allowance is RM500, now is only RM200. The practice should be the higher qualification you had or going to have much higher paid you get. I know it depends on the company as well. The salary that I get is different with the permanent worker. The permanent worker gets higher paid than me.

Researcher : What other disadvantages besides the allowance?

CS2S3: Hmmm...

Researcher : You have mentioned just now about the time management. If you are not working, do you think the time is enough for you to learn?

CS2S3: Yes, I think it would be enough. Before this I used to go back late at night, sometimes I go to other department to learn other things because I don't want to focus only on one thing. If possible I want to learn all the equipment available in the hospital.

Researcher : Is there any training provided to enhance your soft skills?

CS2S3 : Not proper training, they used to train us indirectly at site.

Researcher : Ok, we come to the last question (both of us laugh).

CS2S3: Ok, if there is no request it is ok for me.

Researcher : We have discussed about the advantages and disadvantages of WBL, soft skills assessment and so on. Is there anything that you have missed out and want to add some more?

CS2S3: I think that is all that I want to share

Researcher : Ok, thank you very much *** for your input and time, I really appreciate it.

CS2S3: You're welcome.

C. Employer's Transcript

Interviewee Name: CS2E3

Date of Interview: 12th August, 2014

Time of Interview: 10.00 AM – 12.00 PM

Researcher : Assalamualaikum Mr ***.

CS2E3: Waalaikumusalam.

Researcher : First of all, I would like to thank you for agreed to be interview this morning just to get feedback on WBL graduates' performance and to update the employer requirement on engineering graduates' soft skills; communication skills, problem-solving and teamwork. The interview will only take about 45 minutes to one-hour duration which depends on your input. Before we start further could you please verify back your name, explain a little bit about yourself?

CS2E3: My name is ***. I am graduating from Malaysia Technology University (UTM) in Computer Engineering back in the year 2000. *** Sdn Bhd is my first company I have worked with since then and until now. When I join this company, I worked as a Service Engineer and in 2006 I have been promoted as Head of Technical Department. Since 2009 until now I have again promoted as Technical Manager.

Researcher : Can you explain what is the nature of business for this company?

CS2E3: *** is actually involved with Dialysis, 100% about Dialysis. It means that we have products, offer services and we have our own Dialysis clinic. Dialysis is often used to treat patient with kidney failure for replacement that we usually called as RRT – Renal Replacement Therapy. That is why in our company, we have divided into two main divisions; product and service provider. For technical department, we are placed under Product Division. It includes with sales, technical services, marketing and we have education training centre. In this department, our job description is mainly after sales support. We have products like dialysis machine, Reverse Osmosis System – to process the water, PT machine for peritoneal dialysis. In dialysis we have two types of product, PT – Peritoneal Dialysis and HD – Haemodialysis. Most of the HD we conducted in our centre, some in home based but very less but for PT I can say about 80% are at home.

Researcher : I see, you mean there are some at the patient home, clinics and hospitals.

CS2E3: Yes, because for HD we have many private centres. If you realised they usually operated in the shop house. For technical department, we have to support all; water solutions, HD and PT. Service engineers are first responsible to install, explain basic maintenance and operation of the machine, being able to communicate with the customer. Second, service the machine or we called PPM. Usually for PPM we have arrange for at least once a year for HD and PT except for water solution where we arrange twice a year. Service engineers need to fix date with the customer to run the PPM, either in the centre or their home. Third, our service engineers need to respond with the break down call, means that they need to repair the break down machine. During this process, they are requiring to communicate with the customer; verify with the customer what is the problem they have faced, suggest the customer what are the parts to change, negotiation on the price because we have given them right to give discount to the customers up to 10% from the standard price and when both parties are agreed then they need to repair, test run, prove the machine has been fixed and get the customer to verify their work. Basically those are what we expect our service engineer to perform. Communications with the customers are critically important for service engineer because that are their daily routines. In customer minds, when they know that we are technical person, they thought we know every single thing. They are not asking about the technical only, sometimes they will ask about the operation and clinical as well. So as service engineer in ***, they need to have basic knowledge of clinical at least. We didn't expect them to be someone who really knows well about the clinical because it will not be fair to them. For example, customer might ask our engineer why is my patient during the treatment become hypotension. This is clinical question. Basically hypotension is low blood pressure (his phone ringing and he ask my permission to pick up the phone), so when it happened I always tell them do not ever say that you don't know about it. They need to know at least what is 'hypo', what is the cause and so on.

Researcher : I see.

CS2E3: Our engineer should be able to explain a little bit for example the patient become 'hypo' maybe because of the blood pump running too fast and so on, but for confirmation and more details about the matter they can call our nurse in the office.

Researcher : Means *** have their own nurse?

CS2E3: Yes, we have the nurse to support the education.

Researcher : Hmm that is impressive.

CS2E3: But we do expect our service engineer to brief a little bit before they can ask our nurse. If things get complicated, we will ask our nurse to speak directly with our customer. Similarly, if the customer asks a lot of question regarding the products, our service engineer can refer to our business executive to get clarification. But please do not reply I don't know about this and this in the first place. We know that this is beyond their job scope, but since their nature of work requires them to know, they need to have basic knowledge about it at least. It is because based on my experience, when we are called as an engineer, customers out there expect we have all the answers for all their questions. To have good communication skills and to acquire high confidence with your work, we need to have sufficient knowledge about our working environment.

Researcher : Yes, true. I am totally agreed with you. But if they have knowledge and they are not able to explain, I guess it will be a problem with you as well.

CS2E3: That is why I think communication skills are important. They might think they have explained well to the customer but if the customer can't understand what they are talking about then you can assume the communication has broken down. Customer tends to misinterpret what they have been explaining. For me it is enough if you can use simple words but compact.

Researcher : What are the requirements to become service engineer in ***?

CS2E3: To become service engineer for ***, minimum requirement we are looking at least for diploma and degree graduates. There are some Masters candidates applied but we didn't consider because we feel that they are over qualified. Another thing is because our nature of job is field engineer, more to hands on type of graduates. I think Masters graduates are suitable for administration and management work.

Researcher : What about their discipline of study?

CS2E3: We prefer graduates in Electronics, Electrical and even Mechanical. Although our machines are more to Bio-Medical, those Electronics, Electrical and Mechanical graduates can nicely fit in the job. It is because most of the machines involve with electronic parts, hydraulic parts – water not oil base, computer parts and so on. For Civil engineering I believe they are not suitable for this job because it is not relevant at all.

Researcher : Ok, when you hired the fresh graduates, do you conducted any kind of training in sense of the technical and their soft skills?

CS2E3: What we have done so far, we didn't focus much on the soft skills; we are more focusing on their technical skills. For example, when they started to join, our personnel conduct an orientation programme for a week. In this programme, every department will present what are their main tasks and objectives for the company. For my part, I will present about the technical; what is the equipment that we have, what are our daily routine works and so on, so that they can understand the company structure and others responsibility in the company. Once they have completed the orientation programme, for technical personnel, usually I will introduce a bit about our machines, not too details just brief on the surface for example the basic knowledge about dialysis machine; how it is operated, what is going on during the dialysis process, diffusion concept and so on. After about one month I will instruct them to follow senior engineer to the site. They need to observe how the senior performing their work, how to communicate with the customers, how to repair, how to open the hydraulic power pack, identify each of the parts and slowly they get into the working environment. I don't want to conduct theory class earlier because I know that they will not appreciate and can't see the actual things that I am talking about. They also need to know how to service the equipment. Just after a month or two, then I will conduct the technical training for a week. Basically it covers the theoretical part, basic function of dialysis, dialysis machine operational, hydraulic system; identify all the parts in the machine and so on. I found that this approach is very much efficient because we have exposed them earlier and they are aware with what I am delivered during the training. After the theoretical part, then I teach them the calibration and flow diagram. Our dialysis machine is using the hydraulic concept, so basically I teach them how to repair. For the electronic parts usually we did not repair, we just change the whole board because you can't repair the board as it has so many layers on it.

Researcher : Yes, it is true. Current technology we have multilayers PCB; it is hard to repair.

CS2E3: Similar with hydraulic pump we just able to troubleshoot; identify the cause, if it is faulty we just change with new one because for current technology it is hard to repair. For example, if we found this board is faulty, we will not troubleshoot the board, just replaced with the new board. I think everyone is applied the same to all the machines.

Researcher : What valve did you use for the dialysis, is it proportional type?

CS2E3: No, it is called as the magnet valve or electronic valve.

Researcher : I see, so it is not a proportional type where you can control the flowrate and so on?

CS2E3: No, just on/off 24 VDC valve. Similar with the motor, it used 24 VDC supply because the volume that it need to control is small. The machine is required to control the flow only for 800ml/min and pressure just 2.1 Bar. That is the maximum pressure. Usually for electronic parts it just involves with 5 VDC supply. That is why usually at site we have three outputs from the power supply; 5 VDC, 12 VDC and 24 VDC. Ok, back to the training content, we have allocated 5 days for the training, we taught them what are the rules and regulations that they need to follow, machines' calibration, how to service the machines and so on. At the end of the training we will conduct a test. Everyone needs to pass the test to acquire the certificate. If they did not pass, we consider them are not qualify to repair the dialysis machines. They can only follow the seniors and help the seniors. *** did not allow them to work alone, that is our policy.

Researcher : That is more to the dialysis machine certificate isn't it? Is there any certificate like for safety and health certificate they need to acquire in order to allow them working in this discipline because their work is mostly involving with medical instrument?

CS2E3: For the time being, we don't have requirement to acquire those certificates from the government. The certificate that I told you earlier is only for our technical staffs to acknowledge that they are qualified to work.

Researcher : What about soft skills training?

CS2E3: For communication skill training it involved with all the personnel not only for technical personnel. Usually *** asked third party to conduct the training, I think once or two times a year.

Researcher : Can you describe what are the training contents?

CS2E3: It has topics such as how to communicate with the customer, how to respond with customer questions, how to control the situation when the customers are not satisfied with something and so on. I attended the session myself last year or last two years. For example, if the customer is not satisfying with the product or with us, first we need to do is listen, concern, acknowledge and understand the problem, and then after that try to counter back the situation. Do not ever counter during the customer try to explain on what is going on because it will make it getting worst.

Researcher : Is the approach similar like the technical training where at the end of the training there will be test conducted?

CS2E3: For a time being the training is handled by the outsider, they didn't conduct any test.

Researcher : During the training, does it involved with the practical sessions?

CS2E3: Yes, they have. We are divided into 4-5 groups. Then the trainer creates one situation and we need to act the scene.

Researcher : Means that the training is not mainly for the communication skills, indirectly it involved with the teamwork skills as well isn't it?

CS2E3: Yes, yes you are right. Usually when we called for the training they are conducted 2 in 1 training; communication and teamwork skills. Usually for teamwork we conducted a team building in once a year without family. In the team building we have some kind of group activities which can motivate and work something in a group. Last year we managed to do our own team building mainly for technical personnel. Currently we have about 22 personnel, the biggest division in this company. We engaged with one of the hotel in Malaysia, we let them arranged the group activity for us as long it can create a teamwork among us.

Researcher : Can I know as a manager in technical, how do you assess your staffs' teamwork skill?

CS2E3: Actually I don't contact them directly because under me there is another level which my staffs need to go through. Basically there are 3 supervisors under me and under them they have their own team. That is why most of the feedback I will get it from the supervisors. Frankly, we don't have black and white assessment for the teamwork.

Researcher : But does the teamwork skill include in the KPI or during the appraisal?

CS2E3: Yes, of course we have it in our appraisal but I will get the feedback from the supervisors how do they get along with each other. In my department, teamwork is important because like I have mentioned earlier I have HD team (Haemo-Dialysis) and water solution team. Although they are in separate team, for example water solution team need extra man, so HD team member will be loaned to water solution team and vice versa. We can use the approach because they have the same background and we have trained them earlier the basic of our product. Of course the particular team member has more knowledge than then one who have been instructed to help but they still can manage to do it. That is one of the activities that we have. Another activity is when one of the team members facing problem at site, another personnel who is free at that time come to back him/her up. This is not instructed by us; this is based on teamwork spirit that we have developed earlier. Of course before they can go and help other colleagues, they need to inform their respective supervisor. From there we can see their willingness to help other colleagues who need help. Some more during the public holiday and during the weekend, we have planned out the schedule who is going to work this date and so on. Say for example 'A' needs to work this weekend and he is not available, he asks someone to swap with his timetable. Basically there will someone help to replace his schedule and that is another teamwork criterion I would consider, the toleration among them. And again they need to inform their supervisor on the changes. Before this we let the supervisor to arrange the schedule if someone can't make it, but lately we let the staff arrange by themselves just to see their initiative, cooperation, toleration and communication among them. If the supervisor instructs the changes, maybe it is not his willingness to replace his friend; it is something like we force them to work. When this is happened, it will create dissatisfaction with someone that he replaced earlier. Sooner or later it will affect the relationship. We try our best to harmonise the staffs' relationship.

Researcher : Can you describe how is the format of KPI assessment for the teamwork?

CS2E3: For teamwork, the supervisor need to comment how is their engineer performance in a group work. We don't have the kind of assessment which we just need to tick a box whether or not the engineer very good, good, bad or very bad in teamwork. I think our assessment is much more details as we need to brief how the engineer has showed their teamwork skill.

Researcher : Is it similar approach with their communication skill?

CS2E3: Yes, it is. Similar with the attitude, teamwork, job knowledge; those are the main assessment. Other than that the assessment covers such as their impression, satisfaction and dissatisfaction towards their work.

Researcher : I see, what about the KPI assessment on the problem-solving skill?

CS2E3: Is it for technical or business executive?

Researcher : For technical.

CS2E3: Let me explain the business executive first. Usually for business executive, when they want to solve a problem they did not involve with the hands on, more or less by explanation; it requires good communication skill with the customer. Whilst for technical person or I would say the engineer, their nature of work is more to hands on or practical. They have less explanation to do if they have not repair the machine yet. They have their own priority; repair the machine (both of us laugh). However, they need to be able to negotiate the repairing price, be able to explain why the machine is break down, what are the parts need to be replaced and how long it is going to take for the parts to arrive if it is not available in store. This is to avoid dissatisfaction among the customer. The percentage of communication skill for the engineer is lesser if compare with the business executive because their time are more with repairing the machines than the human interaction. Most of the time, we spent about one to two hours to repair the machine. Maybe it took just 10 minutes or so communication with the customers; get acknowledgement with the customer, explain what have been done and so on. Next they need to rush to another location (his phone ringing and he just ignore the call). That is why I said time with customer is limited.

Researcher : Usually, how many jobs they need to cover in a day?

CS2E3: It depends on the number of break down call, I would say in average we have about 2-3 break down calls.

Researcher : What about the PPM?

CS2E3: In HD case, we have divided into two teams consist of 4 personnel. Every month we will rotate the schedule, for example this month Team A will cover the break down, while Team B will cover the PPM. For next month it will vice versa. PPM is the routine job for technical personnel. It does not require high knowledge of person because the job does not require them to troubleshoot. It involves with very basic work such as cleaning, lubricating, and calibrating, but less communication with the customers. Probably one personnel need to service 5 machines in a day, so basically 10 machines for a team. Sometimes we separate them into different locations depends on the workload for that centre (his phone ringing again).

Researcher : I forgot to ask earlier, during the job interview, have you ever experienced notice that the graduates' academic result does not represent their actual knowledge and skills?

CS2E3: First of all, what we look during the interview is the confidence level when communicating and answering the interview questions. From the way they communicating with us, we can know already their ability in communication skill. Sometimes, there are graduates who just non-stop talking but not relevant with the questions or topics that have been discussed but at least we can see that they are confident. But if they talk nonsense we can't accept it, it is way too much. Frankly speaking until now I am quite upset with the graduates' quality that HE has produced especially for those who are fresh graduates. Sorry to say especially for Malay graduates, they are not able to speak in English fluently, I would say below the average. In the resume, they stated 7 or 8 for speaking in English but in reality they are not at that level. When they cannot master the usage of English, indirectly their confidence level will drop because it requires a lot of thinking before you can answer the question. Sometimes they want to answer but they just don't know how to express it (his phone ringing again and ask my permission to answer). I am sorry about this. Ok, back to the communication skill, we are most concerned on their confidence level. When we ask short question, we expect them to explain briefly and not answer shorter than the question (both of us laugh). Yes, this is the real situation for our graduates nowadays. For example, when I asked them what they have learnt in the university? They just answer I learnt this and this subject. I don't want to know what subject have you learnt because it is already stated in their resume. Instead of listing all the subjects that they have learnt, I would expect them to tell me briefly, what are the contents of the subject that is related to the position that they have applied for. At first I will test their English language, identify at which level are they in, usually if Malay we will mix Malay and English language throughout the interview. Different with Chinese graduates, they can communicate via English fluently because they used the language in their daily life.

Researcher : I see.

CS2E3: We are not cruel; we will see which language that the candidates comfortable with. Usually we will conduct the interview using the language that they prefer us to use. But for sure we will note down in our evaluation.

Researcher : So it is not compulsory requirement that the candidates who want to work in *** must speak using English language?

CS2E3: Not necessarily. At least they can understand when people are saying in English, know how to reply or respond back to the question and so on. Our manuals, paperwork, documentations and trainings are all in English medium. It is because *** is a multinational company. My boss is based in Singapore and he is a German. We also have visiting management from Australia.

Researcher : Is *** local or international company?

CS2E3: *** is a German company. Please remind me back to explain about this company after I answer your previous question. Our fresh graduates' confidence level is below the average and hard to accept by the industry. In sense of their appearances and preparations are very good. Documents are well prepared; in order I would say. It is just they lack of confidence. We can see clearly during the interview, if we ask and they don't know the answer they will like look around, we can see they are not comfortable and confidence. This will happen later on if the customer asks the question at site and they don't know how to respond, because it has become their habits. Customers nowadays are clever and very particular; they will know when they have been bluffed with nonsense answers. That is in sense of the soft skills. In sense of their technical skills are also not met with our expectation because mostly when we asked what they have learnt previously, they can't manage to answer back theoretically. I think the approach is still similar with what I have experienced before in the university, students learnt just to pass their exam. We tend to memorise things instead of understand it. When I know the exam is next week, today I have started to memorise just for the sake of the exam. After the exam I can assure none of the students can still remember what they have memorise before the exam.

Researcher : Yes, true.

CS2E3: I don't know maybe Mr Farid experience in UK is different with what we have experienced in Malaysia. I have brother who studied in UK before this, he said that Malaysian students in theory they are the best, they can score the exams but when it comes to practical or implementation our students failed to perform. This is because our approach since the primary school is reading and memorise the contents. In UK I believed their approach is more practical and what is required by the industry. That is why when they are graduated from the university, they are mostly working ready. The other advantages when studying abroad is you need to communicate via English whether you like it or not. You practice it every day and that can build up your confidence.

Researcher : Yes, you have got a point there.

CS2E3: I think your research in active learning environment probably can somehow improve the way we are educating our students. Personally I think it is important for the graduates to last long in the industry. In *** recently every two years we conducted a competency test to our personnel. From the test we found that although the staffs have worked for 5-6 years, their knowledge on the discipline is not increases but decreases. Previously I have tried to push and encourage them to gain more knowledge and because that time there is no evaluation taken so they just take it for granted. That is why now we implement the competency test to maintain our quality and performance. If the staffs pass the competency test, they will be promoted to the next level or position. Of course different level will have different questions. From the lower level we have technician, then service engineer, next supervisor and technical manager. Indirectly we motivate them to acquire and to increase their knowledge on their nature of job and at the same time offer equally opportunity to be promoted.

Researcher : I see; they are promoted based on their level of knowledge. I think it is a good practice.

CS2E3: Yes. Another reason why we introduced such approach is to set clear target or objective for them to achieve at the same time it shows clearly the structure that they can climb and what are the requirement to be promoted. It is important to motivate the staff if the management can show the future where and what they can be in a few years' time. One problem that I noticed that our staffs are totally depends on the training provided for them to increase their knowledge; they don't know where to find extra information when they need to. I always highlighted during the training that the training only covers about 50% from the topic; maybe they can only accept 30% from it and the rest they need to find out by themselves. It is impossible to train 100% during the training because of time constraint. Another thing is because they are listening and not doing. It is hard to capture all the contents when you just listening to the lecture. It is different in learning when you want to know compare to where you have been informing something that you are not aware and with something that you don't want to know. From the results of the recent competency test, it shows that our staffs are lacked with the knowledge level and the reason that they replied back to us is because they are not aware and they did not learn this before. For me that is not the answer. As the staff are usually at site doing PPM and break down, they should or they can ask the nurse about the clinical if they are really want to know about it, because mostly when we do calibration, it will take about 10-15 minutes for the machine to be ready. Take this opportunity to speak with the customer or the nurse about the clinical, why this patient hand becomes bigger and so on. Ask anything about the clinical; update your knowledge or whatsoever. At the same time, they can establish their relationship with the customers.

Researcher : I see.

CS2E3: That is another way to acquire new information instead of the trainings, manuals and other type of documentations. Indirectly you can make someone who explained to you proud of how they can make you understand. I don't blame them, similar with me; they have been educated previously to be spoon fed by their teachers and lecturers. When they are not being spoon fed, they don't know where and how to find the information.

Researcher : Yes, true.

CS2E3: I think the easiest way is to google. For example, about the competitor machine specifications and what are the technology involved, although they don't have to know about it but if they have the initiative to find out on those, it will give them an advantage to explain to the customer. They can do sort of comparison and so on but never condemn other competitor product in front of the customer as it is not ethical. What they can do, explain your product strength compare to others. Do not ever say this product is not good or reliable or so on. Customers will not feel happy if you critics other competitor. I admit in my department I have this kind of people talking about other competitors' machine. It is not the culture I want to develop in my department. If the customer heard your condemnation, the customer might felt offended, maybe he/she has make a mistake by buying those machines earlier. There are customers who really sensitive, if you offended them there is possibility you can't enter the centre anymore in the future. We don't want that to happen and we don't want to offend anyone. During the explanation or communicate with the customer it requires staffs' critical thinking as well. We also look on this criterion during the interview. For example, we gave questions on arranging the boxes; most of the candidates are not able to answer the question.

Researcher : I see. Critical thinking is depending on how you able to solve the problem.

CS2E3: True, and how fast you can solve it. Currently we only have one question regarding the critical thinking; probably in the future we need to have sets of question to test their critical thinking. We are developing from time to time.

Researcher : Who sets the question?

CS2E3: The interviewer mostly. Usually we just refer to the internet. What we did, is we ask them to write their answer at the white board and explain briefly. The answer is not absolutely right or wrong, it is just we want to see their thinking skills. As I mentioned earlier the candidates who come for the interview mostly are not up to our expectation, but because of their level is almost the same so we tried to look the best among that level. I noticed that our fresh graduates can easily learn new things. That is the advantage that I can see. I am also come to this company as a fresh graduate, within one year I can be at the same level with my seniors in sense of the knowledge and skills. When I first joined ***, most of the staffs are senior and experience staffs, but I am in charge for the technical team, I prefer to hire fresh graduates. This is because if I hire someone who have more experience, chances for them to accept any changes or new approach is most likely less. They will have stuck with the old way of doing things and hard to listen to our suggestion. Whatever they have experienced previously is not necessary correct and according to the right procedure. For fresh graduates, we can easily teach them and they can easily adapt with the environment that we want to cultivate, the way we want them to perform. For me knowledge needs to be updated concurrent with the technology and some of the seniors don't feel like it is necessary to learn new things. They are being in their comfort zone. That is why I more prefer fresh graduates compare to someone who have experiences. I can make sure fresh graduates within a year can meet the same level of knowledge with my senior staff. In sense of the skills of course the seniors are better.

Researcher : And they are easier to follow the instruction isn't it?

CS2E3: Yes, they are, but what I like most is their knowledge in the theoretical were much better than the seniors. For me if you have strong knowledge on the theory, at the same time we gain the practical experience, within 2-3 years we can be the specialist in whatever we are doing. For the seniors, they are doing their work-based on experience only. For example, when one machine breaks down, they will usually say this part is faulty. Why the part is faulty, they are not able to explain and justify. I can confirm with you, my staffs that have 5-6 years experiences still using trial and error to solve the problem at site because they are lack of theoretical background. Just guessing what is the part that faulty. It is different with the fresh graduates; they can troubleshoot from one block diagram to another and justify the faulty. It also gives them the confidence to explain to the customer what has gone wrong and what parts they will change. That is another reason why I prefer fresh graduates. I don't mind at first they are lacked with experiences, soft and technical skills but as long it is easier for us to form them in the way we want, it is good enough. It is not I take advantage on them but it is for their own good. For me to become successful technical personnel, experiences must come with the strong knowledge and skills.

Researcher : Ok, I would like to ask question specifically regarding the WBL graduates that have been working for ***, can I know how their soft skills are when they first join this company.

CS2E3: Like I have mentioned earlier, their level soft skills are not up to our expectation, very disappointing. But since they have the technical knowledge and skills, we can consider them to work here; perhaps they have a good attitude. So far, I am satisfied with the attitude of SAP graduates; in sense of diligent doing the work, discipline and so on, they are quite good. In sense of the soft skills we still need to do something about it as they are lacked on it especially when speaking using English language. I can give them 3/10 on their communication skill. They can understand when reading but they are not able to talk, speak or explain. But when they have experienced during the meeting, training, working at site, they will gain their confidence because usually our medium language is English. I am not sure in SAP, are they using English as the medium during teaching the students?

Researcher : According to the documentation, yes they have been taught in English but I am not sure in sense of its implementation.

CS2E3: My experience in UTM, we have been taught using Bahasa (Malay language) but the handouts and books in English. That is why we can read, but we are not able to speak. Our listening skill is also not so good. My first experience with native speaker is an Australian. As a technical manager, the job requires me to communicate with overseas personnel around the world. It is hard for me to catch what he is trying to say, I mean the Australian. Their slang and dialect is different with us. It is hard at first but now I am able to communicate with them effectively. In university, we have been trained to learn through reading but not learning through speaking or doing.

Researcher : In education, we have many styles of learning, some students learn through reading, some through listening, doing, seeing and so on. Those who can learn through reading are advantage for them because most of the exam questions are coming from the handouts and books.

CS2E3: Yes, it is true. My experience when interviewing the graduates, I am impressed with the academic results that they have achieved, some scored second class upper and there are also graduates who get first class honours. I can say all the students are not good with their communication skill because most of them are 'bookworm'. They feel not comfortable to communicate with others. When we asked them to perform some work, they not manage to do it. It is sad to see this happened. For example, my own sister, she has performed well during her degree, I think she scored first class. UTM offers her to further her PhD and she is about to finish. I can see her communication skill is not so good because she is not comfortable speaking and socialise with others, always concentrate with her books and research. For me she needs to balance out study and socialise with surroundings. Previously what I studied in UTM, I guess I have learnt most of the time is theory, less practical. No matter how good is your theory but if you don't have the hands on or practical, you can't go anywhere in the industry. Perhaps you can only perform well in education environment.

Researcher : Yes, I agree with you.

CS2E3: Another thing is what we have learnt in the university not all can be applied to our work. For example, the calculus, until now I don't know where to apply it (both of us laugh). It is hard to pass the calculus subject, and yet you did not even apply in your daily work. Similar with current graduates, when I was graduated and offered a job, I don't know anything about the task at all. The advantage for university graduates as I have mentioned is they are fast learner.

Researcher : Nowadays they are called lifelong learning which the students or graduates are able to adapt and learn within the new environment in a shorter time. Ok, just to remind you that you want to explain on your company background.

CS2E3: O yes. FMC is actually under Fresenius Groups. It is based in Germany. It is a family business company. And currently it has become public company. Under Fresenius Groups, we have about 4 other companies; one of the companies is FMC – 100% on dialysis business. The company has been divided into product division and service provider. For product division we have our internal customer because we sell our product to them and we provide after sales services. Under Fresenius Groups, FMC are the biggest company among others especially in US branch. So far we have covered about 40% numbers of dialysis patient in US. It consists of 2000-3000 dialysis clinics around US. Another company under Fresenius Groups is Fresenius Kabi (FK), I am not sure if you have heard about this company. This company focuses on the nutrition and more to the ICU product like the infusion pump. Recently we have bought one company namely Fresenius Helios (FH) but not in Malaysia. This company is responsible for hospital management. For example, if KPJ wants to build new hospital, they will engage with FH to develop the hospital.

Researcher : Is it like a software provider?

CS2E3: No, it is not software, it is a management; how to manage the hospital. Basically KPJ management are not the one who runs the hospital. They awarded a contract to FH to run the business for them. Probably they can save the cost for hiring the management or whatsoever. Personnel from general manager level until below level are FH personnel. KPJ just provides the fund and they only want the profits running the business. Once the contract has lapsed, FH will transfer the hospital back to the KPJ. The fourth company is Fresenius Vamed (FV). The company nature of business is more to Bio-Medical equipment consultant. For example, if there is new hospital to be developed, FV will enter the tender in supplying Bio-Medical equipment to the hospital. Currently they are consultant for Shah Alam Hospital. They have been a consultant for PPMC, Sungai Buloh Hospital and many more.

Researcher : Is your market only for Malaysia or you need to cover the Asian countries?

CS2E3: We only cover market in Malaysia; FMC, FK and FV. Allow me to explain brief about FMC. We have divided into regional area; Europe Region, US Region and Asia Pacific Region. For Asia Pacific (AP) region, our head quarter is in Hong Kong. Under AP region, it is divided into several other divisions; Central AP, China, Taiwan and South Asia Pacific (SAP). Malaysia is under South Asia Pacific. Other countries are Indonesia, Singapore, Australia and New Zealand. FMC is very big company and our revenue if I am not mistaken is about 12 Billion USD per year.

Researcher : That is a lot. I did not aware of this since I am in different background.

CS2E3: Yes, we are the biggest dialysis machine provider in the world. Our competitor such as B Braun but recently they have slightly dropped from the market. FMC established in Malaysia since 1999 so we are still developing. Before this we are covered by Singapore. I joined this company in 2000, so I am among the pioneer worker here. My worker number is 007 so you can imagine how long I have been working here. I think there are only 2-3 first badge workers left in the company; others have left to other competitors. FMC Malaysia is not very big, last year we managed to achieve 100 Million Ringgit revenue.

Researcher : 100 Million Ringgit revenue is a good achievement for not so big company as you declared earlier. Ok, you have brief what are the requirements to work in this company, what are their job descriptions, attributes that represent the soft skills that we have discussed; communication, problem-solving and teamwork skills. Throughout our discussion, do you have anything that you have missed out and you want to add some more?

CS2E3: One more things that I would like to share during the interview experience, most of the graduates does not know anything about the company they applied for work. Maybe HE could highlight this issue to their students. Make sure they do some ground work or research on the company that they have applied to work with, get to know their nature of business, when it is established and so on. It is because it shows the graduates looking forward and interested to work in those environments. Sorry to say, but usually if I asked the Malay graduates about our company, mostly the answer I would get is I am not sure or I don't know sir.

Researcher : Really?

CS2E3: Actually in our website, we have an introduction, brief about our nature of business. We don't expect them to know details about our company, just show your awareness and interest in our company. It is totally different with Chinese graduates. If I ask them what FMC business is, they can repeat exactly what we have in the website. It is good enough for us.

Researcher : Is Malay graduates that bad?

CS2E3: Yes, most of them. I think if you go anywhere to interview, that will be a basic question to be asked by the interviewer.

Researcher : Yes, true.

CS2E3: They need to know our nature of business, the position that they are applying for and so on. Sometimes we do ask their expectation in this company. Probably you would not know the task for service engineer for example but somehow you need to have your expectation.

Researcher : Maybe you could suggest on soft skills improvement that HE can do in the future?

CS2E3: If possible for final year student, HE could arrange or conduct special class mainly for soft skills development; how to communicate, how to build up your confidence, right way to respond and answer when question been asked and so on. For example, when answering simple question; how are you today? Usually for normal person, they will answer 'I am fine, thank you'. But for extraordinary people they will answer 'I feel great or I feel wonderful' that makes them different with ordinary people.

Researcher : Don't you think it is too late to do the class during the final year?

CS2E3: If the subject can be done earlier is better so that you can have stage by stage that you can monitor their progress. Maybe what HE can do, they develop a module Communication Skill 1 and Communication Skill 2 so that you can have higher objective than the other. I guess it can be done within two semesters. I am sure they can develop the skills to communicate and answering the question. I am not sure how the education nowadays, during my studies, when we do projects there will be a short presentation at the end of the project. That is the only opportunity for me to speak up in front of the people. Maybe HE could provide more activities and opportunities for their students to develop and practice the soft skills. Me myself when my first time been asking to present in front of the staff, I am shivering throughout the meeting but I try to improve myself from time to time. In 2003 I been invited to become a speaker in QID – Quality in Dialysis conducted in one of the hotel with around 500 participants, it is my turning point. Of course at that time my nervous level is at the maximum level. I can't see anybody in front of me, I am visionless but I am doing well during the presentation and get positive feedback from the participants. Since then I don't have any problem in communicating with the native speaker, presenting and so on. I can be natural presenter, make a jokes on the stage and whatsoever. When we have make used with it, we don't need any material or slides in front of us anymore. People said practice make perfect. I still remember during my final year project in UTM, I need to present in front of my supervisor and few other people, the feeling of nervousness is different, less pressure because less people attend the presentation.

Researcher : Yes, something like a public speaking isn't it?

CS2E3: Yes. That is why I would like to suggest maybe from the first semester until the end of their studies try to integrate the soft skills element in the syllabus. I am sure you will produce graduates who can meet the industry demand. This could be a selling point for them during the employment interview. Most of the consultant companies prefer their worker to be able to present and explain to their customer. This is one of the communication skill elements that need to possess by our graduates. Sometime what we did during the interview we prepare two or three slides and ask the candidates to present the contents. I can say most of them are not able to present effectively. For your information I am qualified trainer for FMC. To become a qualified trainer, I need to pass TTT certificate. During the TTT training I have been taught how can we posed a questions; in active and passive way. We are encouraged to ask passive question which requires the answer to be more than yes or no answers. I learn how to control my body language, face expression and standing positions during the presentation. Usage of pointer and media, eye to eye contact with the participant and so on.

Researcher : I see, so FMC sent you to attend TTT training to qualify you as a certified trainer?

CS2E3: Yes. TTT training is basically train you the right approach to teach your participants or students. It is a way to engage and make them understand.

Researcher : I see; it is something like pedagogy training in education.

CS2E3: Yes, something like that. I have strong feeling that HE can use that kind of approach to train the students. What I wish to see during the interview is something different what we have experienced before. I would like to see their initiative to present themselves. What they can do probably bring their own laptop or whatsoever, prepare few slides and explain a little bit about their self. I am not generalising for all company wishes. Indirectly we as an employer be able to see their confident level during the presentation at the same time knowing something about them.

Researcher : Of course employer want HE graduates to be work ready after they have complete their studies. Based on your experience, how can we improve our graduates' soft skills development in HE specifically?

CS2E3: Personally what I have seen, in sense of the soft skills there is not much for them to improve. I am more concern about our students have been exposed much on theory rather than the practical. I get to know, that oversea graduates during their study they have an opportunity to attach with the company. I think that is a good approach to expose the students not only on technical but also for the soft skills, for example communication skills, motivate their thinking skills, adapt with the working environment, handle pressure from your superior. You know why, pressure during working and learning is totally different. Normally, when they first start, it takes time for the students/graduates to accept the pressure. I have been experienced doing my placement 3 months in the university during my degree. In my mind that time I just think of getting pass for the placement, because there is no guidelines on what you need to cover and discover. There's also no structured syllabus and objective on my learning like what have been arranged in the WBL.

Researcher : I see, that is the advantage of WBL isn't it?

CS2E3: Yes, true. Talking about communication skills, as a student, if you know one thing and you are not able to explain it, people will judge you that you do not know about that things. We didn't expect you to know everything during the interview because we are aware of they are fresh graduates compare to someone who have experience, then we will expect more from them. For fresh graduates, our concern is to see their personality, how they can promote their communication, confident level, what do they think about their future, their future planning and so on. For example, in 5 years' time, how can you see yourself in your career? Maybe they said to be a good engineer, I did not say it is wrong answer but I expect the answer to be more than that. For example, they could say, within 5 years I would enhance myself with knowledge and skills, explain a bit how they can accomplish their objective, and improve their English language and so on. Probably in 5 years' time I would see myself promoted as a manager in this company. You see, the answer is different where you support your plan with how you can accomplish it. We want to see how their thinking skills is, future planning and what is their objective working for this company, probably for company or personal benefits. I like the way my European colleagues' communication ability. They able to explain brief in an interesting way, probably because English is their first language but for me that is not an excuse. Frankly, I have learnt a lot from them. What I have realised when our students doing presentation, they are lacked with preparing the slides presentation, we don't really feel nice about it.

Researcher : Yes, the first slide is the first impression to the listener, whether or not the presentation will be interesting.

CS2E3: True, that is why I would like to recommend if HE can provide our students with this kind of training, it could make much benefits for the employer. In university, it is acceptable for you to make a mistake, but in industry any mistake could minimise company profits and even create lost to the company. Not even that, their reputation will also affect.

Researcher : Any other suggestion Mr ***?

CS2E3: Hmm I would like to suggest also for HE to conduct software training. In industry, we can't run away from this 3 software's; Microsoft Power Point, Excel and Words. Common for fresh graduates, they are familiar only with Microsoft Words and only at basics level. In my working field I would say, we involved more with Microsoft Excel because there are so many formulae, calculations, projection, produced graphs and whatsoever. Especially when you are at managerial level, Microsoft Excel is a must software to be expert with. From the projection or graphs will be used in Microsoft Word if it is required for report writing and Microsoft Power Point if it is required for the presentation. Those software skills should be embraced during the HE, because once you are working you will not have time to learn and play around with it.

Researcher : Do you think it is important for HE establish relationship with the industry?

CS2E3: Of course, I would love to see HE have close relationship with the industry. Besides the technology updates, we as an employer could provide our latest requirement and feedback of their graduates and at the same time to our potential workers on what to be equipped with. The logic is like this, university education should train the students with the latest technology, latest requirement from the employer not the previous 5 years' syllabus. It has been outdated. I know HE limitations that they are not able to equip with the latest technology equipment, but what they can do is to make the students aware of the current technology, updated the syllabus and so on.

Researcher : When talking about computer for example, the evolution is so drastic isn't it? In Bio-Medical Engineering, how fast does the technology evolve? In other words, how frequent do you recommend for the HE to be updated with the industry?

CS2E3: From my experience working in this field, frankly next technology is already there for the next 20 years I believed, but the inventor controls the market. It is called marketing strategy. From my observation, I would say new technology evolved every 5 years. For sure you can see every year it is changing, but they are small improvement, just for update for example. So I would recommend HE to be up to date with the industry for every 5 years. If not been updated, I can say whatever the students learnt is no longer relevant for us. I did not say that I am right about this, probably I am wrong.

Researcher : No worries Mr ***. I am asking you about this because you been long in this field. Ok, we have talked about your company, your experience with WBL graduates and other engineering graduates, soft skills attribute that you think important for our graduates to possess and so on. Throughout this interview, is there anything that you have missed out and you want to add on it?

CS2E3: I guess I have talked a lot this morning (both of us laugh).

Researcher : Thank you Mr *** for your kind input on my studies. I really appreciate your time and cooperation.

CS2E3: My pleasure.

Appendix 7 – Approval Letter to Conduct Data Collections

A. First Case Study

[redacted]

28th April, 2014

Muhamad Farid Bin Daud

No. 40 Jalan Sari Ilham ½

Alam Sari

43000, Kajang

Selangor Darul Ehsan

Dear Sir,

APPROVAL FOR CONDUCTING A RESEARCH WITH A TOPIC OF "HOW ARE GENERIC SKILLS ASSESSED WITHIN AN ACTIVE LEARNING ENVIRONMENT IN THE HIGHER EDUCATION SECTORS OF MALAYSIA AND THE UNITED KINGDOM?"

With respect to the above matter we are pleased to inform you that we do not have any restriction to cooperate and allow you to conduct your research in [redacted] Institute. We will give full support and assistancefor smooth implementation of your research.

If you need any further clarifications please contact me, [redacted]

Regards,

[redacted]

[redacted]

B. Second Case Study (Polytechnic Studies Department)

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[redacted] : [redacted]
[redacted] : [redacted]

[redacted]

[redacted]

KEBENARAN MENJALANKAN PENYELIDIKAN BERTAJUK "HOW ARE GENERIC SKILLS ASSESSED WITHIN AN ACTIVE LEARNING (AL) ENVIRONMENT IN THE HIGHER EDUCATION SECTORS OF MALAYSIA AND THE UNITED KINGDOM?"

Saya dengan hormatnya merujuk perkara di atas.

2. Sukacita dimaklumkan bahawa pihak kami tiada halangan untuk memberi kebenaran kepada tuan untuk menjalankan kerjasama dan kebenaran penyelidikan bertajuk " **How Are Generic Skills Assessed Within An Active Learning (Al) Environment In The Higher Education Sectors Of Malaysia And The United Kingdom?"** seperti yang dijelaskan dalam cadangan penyelidikan yang disertakan.

3. Sebarang pertanyaan lanjut berkenaan kajian penyelidikan yang akan dijalankan, sila hubungi Ketua Unit Penyelidikan Politeknik yang berkenaan untuk melancarkan lagi pelaksanaan kajian.

4. Untuk peringatan, tuan hendaklah mengemukakan senaskah laporan akhir kajian tersebut ke Pusat Penyelidikan dan Pembangunan Politeknik (PPPP), Jabatan Pengajian Politeknik. Dimaklumkan juga bahawa tuan adalah diminta mendapatkan kebenaran terlebih dahulu daripada PPPP sekiranya sebahagian atau sepenuhnya dapatan penyelidikan tersebut hendak dibentangkan di mana – mana persidangan atau seminar, atau untuk pengumuman di media massa.

Sekian untuk makluman dan tindakan seterusnya, terima kasih.

"BERKHIDMAT UNTUK NEGARA"

[redacted]
Pusat Penyelidikan dan Pembangunan Politeknik
Jabatan Pengajian Politeknik

Appendix 8 – Interview Questions

A. Lecturer

1. **Demographic**
   Can you describe about yourself?

   - Can you tell me about yourself?

2. **Background**
   Can you tell me about your educational background?
   What is your job scope here at ***?

   - What is your educational background?
   - Is this your first job?
   - Can you describe your previous job experience if any?
   - How long you have been working here?
   - What motivate you to work here?
   - What are your general feelings when you start to work here?
   - Does the feeling changes? If yes, how does it change your feeling?
   - What subject/s do you teach?
   - How long you have been teaching this subject/s?

3. **Teaching**
   Can you share your teaching experience?

   - How do you describe your style of teaching? Lecture or more discussion?
   - Have you used different style of teaching before? If yes, what is it?
   - What are the teaching materials used in the class/lab?
   - How long you have experience teaching in PBL/WBL?
   - What is PBL/WBL exactly?
   - Why do you use this approach?
   - Have you undergone the training before using this approach?
   - What do you think about the advantages/disadvantages using this approach?
   - Have you done any reflections with the students at the end of the class? Why?
   - What is the aspect of teaching that you want to improve differently from previous semester/term?

4. **Perception towards students learning**
   Can you describe your observation towards the student learning?

   - Can you describe the student's acceptance towards this approach?
   - Based on your experience, how do you find student engagement in this subject as compared to previous approach, if you had used any?
   - How about on student's achievement? Technical skills and other skills development?

5. **Generic skills understanding**
   Can you describe your knowledge on generic skills?

   - What is generic/ key/ core/ employability/ soft skills? If they do not know, explain.
   - Why do you think those skills are important for the students to acquire? (problem-solving, team working and verbal communication skills)
   - What are the activities involved to develop those skills?
   - Do the activities help the students to develop those skills? How?
   - Do you think this approach is effective in developing generic skills? Why?
   - What kind of approach/method have you used to develop communication, team working and problem-solving?
   - How do you motivate the students to acquire those skills?
   - What are the factors can be considered to improve the students learning and generic skills development?

6. **Perception towards assessment methods**
   Can you tell me about your experience on generic skills assessment?

   - How do the learning outcome and teaching approach align with the generic skills assessment in this module?
   - Who is design the assessment? How is the process?
   - Is there any external reviewer reviewed on the assessment? Who?
   - How often has the assessment been reviewed?
   - Have you been trained to use the assessment?
   - How often do you assess the students' generic skills?
   - What about the timing of the assessment?
   - What method of assessment do you used to assess those skills? Critical thinking, problem-solving, team working and oral communication skills.
   - Do you explain the criteria of generic skills assessment to the students? What are they?
   - Do you think the assessments are helpful? How?
   - Could please describe what you like and dislike about generic skills assessment?
   - What do you think about the assessment should be changed? Why?

7. **Conclusion**
   Is there anything else you would like to tell me about your experience in generic skills assessment?

B. Student

1. **Demographic**
   Can you describe about yourself?

2. **Background**
   Can you tell me about your educational background?

   - What are your previous qualifications?
   - Where is your secondary school/college?
   - Are you in Science/Art/ Technical/ Vocational/ Religious stream?

3. **Experience before HE**
   - We are going to talk about an active learning in Higher Education. So I would like you to see the definition of active learning before we start. Now, thinking about the definition, I would like you to think back during at school before you became student here, can you describe to me how you have been taught at school, how is the environment and things like that?
   - Do you study engineering before you came here?
   - Why do you decide to study in engineering?

4. **Perceptions on active learning approach (Problem-Based Learning (PBL)/ Work-Based Learning (WBL))**
   - When did you been introduced to active learning environment?
   - Which part of active learning using PBL/WBL have you found good and helpful?
   - What aspects of PBL/WBL approach have you struggled with?
   - Where about in the PBL/WBL environment is better? (workshop/lab/class)
   - How the PBL/WBL did helped you developing your generic skills?
   - How have the PBL/WBL lecturers supported your learning during the module?
   - If you are given one opportunity to improve the way the course is taught, what would it be?

5. **Generic skills**
   - One of the advantages of active learning is to develop students' generic skills. How do generic skills help you in learning?
   - Do you aware that you need to acquire this skill as the outcome of the programme?
   - In which module do you think most effective to teach this skill?
   - Why do you think 'generic skill' is important?

6. **Communication**
   - If you look at this definition, presentation. In my experienced I see students hate to do presentation. How do you find it?
   - At this stage, after undergone few years in ***, do you think your presentation skills have improved?
   - When other students presenting, do you find it useful, does it help your learning process?

- You seem like pretty quiet sort of person, in your group work, how do you share your knowledge or asking questions with others?
- When you disagree in the discussion, do you always make sure your point across?

7. Group work

- By referring to the team/group work definition, can you tell me whether it reflects in your experience working in group?
- Can you tell me what is it like when you were put in a group? What is your task? What about others?
- Is the task given based on your abilities? If not, why? What is your role in the team?
- Did any problem arise during the team/group work?

8. Problem-solving

- Can you describe during PBL/WBL, what are the problems you have experienced and try to solve?
- How do you solve it? Individual or with group member?
- Based on your experienced, what are the steps will you take to solve any problem in the future?

9. Generic skills assessment

- How do you been assessed individually when you are working as a team or group?
- What about oral/verbal communication assessment? Problem-solving?
- Do you think it was fairly assessed? Why?
- Do you think the assessment method assess what it supposed to assess? Why?
- Are you aware the assessment criteria of the skills (team/group working, communication and problem-solving? If yes, what are they?
- Do you aware when will you be assessed? When are they?
- Could you please describe what you like and dislike about the assessment of the skills?
- What can you suggest a way to improve the assessment of generic skills?

10. The whole university experience/ future employment

- You are nearly there to graduate, where do you see yourself professionally in couples of year times?
- Before we end our discussion is the anything that you have missed out and you would like to add?

C. Employer

1. **Demographic**

   Can you describe about yourself?

   - Can you tell me about yourself?
   - What is your educational background?
   - Can you describe your previous job experience if any?
   - What is your position job task in this company?
   - How long you have been working in this company?
   - What motivate you to work here?

2. **Background**

   Can you tell me about your company background?

   - What is the nature of business for this company?
   - How many engineers in this company?
   - What are the engineer tasks?
   - What are your company requirements for the graduates to become an engineer?

3. **Perception towards Engineering Students/Graduates Generic Skills**

   Can you share your perception towards engineering students/graduates from ***?

   - How do you describe engineering students'/graduates' knowledge and technical/generic skills from ***?
   - What are their strengths/weaknesses?
   - Are you looking forward to hire a student/graduate from *** compare to other institution in the future? Why?
   - Is there any assessment done to monitor engineer soft skills performance?
   - Is there any difference with students/graduates from other institution? What are they?
   - Which skills do you think are most important for the engineering students/graduates to possess, technical skills or generic/ key/ core/ employability/ soft skills? Why?
   - When mentioned about graduates communication skills, what are the attributes should the student possess?
   - What about the attributes for team working? Problem-solving? Critical thinking?
   - Can you suggest, what are the aspects of the engineering students/graduates generic skills should improve?

4. **Perception towards Engineering Education**

   Can you describe your perception towards the Engineering Education?

   - What do you think of Engineering Education (EE) nowadays?
   - How is it difference previously?

- Do you think the Engineering Education has aligned with your expectation in students/graduates generic skills? How?
- Are there any initiatives from the *** to get a reflection on their students'/graduates' performance especially in generic skills?
- How often do you recommend for the EE to revise their curriculum and assessment? Why?
- In your opinion, how can you contribute to generic skills development in EE?
- And how do you think EE can contribute to you and your company in the similar sense?
- Do you think it is possible to get a consensus between EE and employer in industry on generic skills attributes of the engineering student/graduates? Why?

5. **Conclusion**

   Is there anything else you would like to tell me about your experience in generic skills assessment in this module?

Appendix 9 – Participant Demographic Forms

A. Lecturer Demographic Form

Aston University
Aston Triangle
Birmingham B4 7ET
United Kingdom
Tel +44 (0) 121 2045246
www.aston.ac.uk/eas/

Active Learning Definition

Active learning is defined as the learning approach that use to enhance students' understanding of learning concepts, ultimately creating the learning and teaching environment interesting, active and more meaningful to students. Examples of active learning approach are Conceive-Design-Implement-Operate (CDIO), Project-Based Learning (PjBL), Work-Based Learning (WBL), Activity Led Learning (ALL) and Problem-Based Learning (PBL).

Demographic Questionnaire

This questionnaire has been designed for you to tell us your demographic details for the purpose of the research. **The questionnaire should take no more than 5 minutes to complete.** The data is confidential and will be stored in accordance with the Data Protection Act (1998). Thank you very much of your time. If you have any queries, please contact Muhamad Farid Bin Daud: daudmfb@aston.ac.uk or [redacted]

Demographic Details

1. What is your name?

   ____

2. What is your institution name?

   ____

3. What is your ethnicity? (E.g. Malay, White British, Mixed White Asian, etc.)

   ____

4. Gender

   a. Male ( ) b. Female ( )

5. Please indicate your highest qualification:

   a. MCE ( )
   b. Diploma/ Higher Diploma ( )
   c. Degree ( )
   d. Masters ( )
   e. PhD ( )
   f. Others: ___________________________

6. Do you have experienced working in the engineering industry?

a. Yes ( ) b. No ( )

7. What is your teaching discipline?
   a. Electronics Eng. ( )
   b. Electrical Eng. ( )
   c. Mechanical Eng. ( )
   d. Mechatronics Eng. ( )
   e. Chemical Eng. ( )
   f. Others Engineering Programme (please specify)________________________________

8. How long you have been teaching in Higher Education?
   a. 1 year ( )
   b. 2 years ( )
   c. 3 years ( )
   d. 4 years ( )
   e. 5 years and above ( )

9. Was part of your teaching based on the Active Learning approach?
   a. Yes ( ) b. No ( )
   Please specify your teaching approach (E.g. CDIO, PBL, PjBL or others)

   ____

10. How long you have been experiencing using the approach?
    a. 1 year ( )
    b. 2 years ( )
    c. 3 years ( )
    d. 4 years ( )
    e. 5 years and above ( )

11. Have you undergone Active Learning workshop or training before you start adopting it?
    a. Yes ( ) b. No ( )

12. Is English used as a medium language in the class?
    a. Yes ( ) b. No ( )
    If **no**, please specify your medium language ______________________________________

Thank you for taking the time to complete the questionnaire. Your kind attention and cooperation is highly appreciated.

B. Student Demographic Form

Aston University
Aston Triangle
Birmingham B4 7ET
United Kingdom
Tel +44 (0) 121 2045246
www.aston.ac.uk/eas/

Active Learning Definition

Active learning is defined as the learning approach that use to enhance students' understanding of learning concepts, ultimately creating the learning and teaching environment interesting, active and more meaningful to students. Examples of active learning approach are Conceive-Design-Implement-Operate (CDIO), Project-Based Learning (PjBL), Work-Based Learning (WBL), Activity Led Learning (ALL) and Problem-Based Learning (PBL).

Demographic Questionnaire

This questionnaire has been designed for you to tell us your demographic details for the purpose of the research. **The questionnaire should take no more than 5 minutes to complete.** The data is confidential and will be stored in accordance with the Data Protection Act (1998). Thank you very much of your time. If you have any queries, please contact Muhamad Farid Bin Daud: daudmfb@aston.ac.uk [redacted]

Demographic Details

1. What is your name?

   ____

2. What is your institution name?

   ____

3. What is your Programme of Study?
   g. Electronics Eng. ( )
   h. Electrical Eng. ( )
   i. Mechanical Eng. ( )
   j. Mechatronics Eng. ( )
   k. Chemical Eng. ( )
   l. Others Engineering Programme (please specify)___________________________________

4. Are you an overseas Student?
   a. Yes ( ) b. No ( )
   If **yes**, please state country of origin ______________________________________

5. What is your ethnicity? (E.g. Malay, White British, Mixed White Asian, etc.)

   ____

6. Gender

b. Male ( ) b. Female ( )

7. Age
   f. Under 18 ( )
   g. 18-19 ( )
   h. 20-21 ( )
   i. 22-24 ( )
   j. 25 and above ( )

8. Was part of your course based on the Active Learning approach?
   b. Yes ( ) b. No ( )
   Please specify your course approach (E.g. CDIO, PBL, PjBL or others)

   ____

9. Please indicate your previous qualifications:
   g. MCE ( )
   h. SKM or other certificate ( )
   i. A level Maths ( )
   j. A level Physics ( )
   k. A level Combined Science ( )
   l. A level Biology or Human Biology ( )
   m. A level Chemistry ( )
   n. A level in Design & Technology ( )
   o. A level ICT ( )
   p. A level Engineering ( )
   q. Business Focused A levels ( )
   r. A level in Arts/Humanities ( )
   s. BTEC ( )
   t. Other Vocational ( )

10. Have you experienced a work placement/internship before?
    b. Yes ( ) b. No ( )

11. Is English your first language?
    b. Yes ( ) b. No ( )
    If **no**, please specify your first language ____

Thank you for taking the time to complete the questionnaire. Your kind attention and cooperation is highly appreciated.

C. **Employer Demographic Form**

Aston University
Aston Triangle
Birmingham B4 7ET
United Kingdom
Tel +44 (0) 121 2045246
www.aston.ac.uk/eas/

Active Learning Definition

Active learning is defined as the learning approach that use to enhance students' understanding of learning concepts, ultimately creating the learning and teaching environment interesting, active and more meaningful to students. Examples of active learning approach are Conceive-Design-Implement-Operate (CDIO), Project-Based Learning (PjBL), Work-Based Learning (WBL), Activity Led Learning (ALL) and Problem-Based Learning (PBL).

Generic Skills Definition

Generic skills are the skills applicable to different and varying situations faced after the learning and teaching process, adaptable to suit the varying needs of fresh situations. Examples of generic skills are communication, team/group working, problem-solving, critical thinking, lifelong learning and many more.

Demographic Questionnaire

This questionnaire has been designed for you to tell us your demographic details for the purpose of the research. **The questionnaire should take no more than 5 minutes to complete.** The data is confidential and will be stored in accordance with the Data Protection Act (1998). Thank you very much of your time. If you have any queries, please contact Muhamad Farid Bin Daud: daudmfb@aston.ac.uk or [redacted]

Demographic Details

1. What is your name?

   ____

2. What is your company name?

   ____

3. What is your position in the company?

   ____

4. What is your ethnicity? (E.g. Malay, White British, Mixed White Asian, etc.)

   ____

5. Gender

   c. Male ( ) b. Female ( )

6. Please indicate your highest qualification:
   u. MCE ( )
   v. Diploma/ Higher Diploma ( )
   w. Degree ( )
   x. Masters ( )
   y. PhD ( )
   z. Others: ______________________________

7. What is your working discipline?
   m. Electronics Eng. ( )
   n. Electrical Eng. ( )
   o. Mechanical Eng. ( )
   p. Mechatronics Eng. ( )
   q. Chemical Eng. ( )
   r. Others Engineering Programme (please specify)_________________________________

8. How long you have been working in this discipline?
   a. 1 year ( )
   b. 2 years ( )
   c. 3 years ( )
   d. 4 years ( )
   e. 5 years and above ( )

9. How many *** students/graduates have experienced training /working in this company?
   k. 1 student ( )
   l. 2 students ( )
   m. 3 students ( )
   n. 4 students ( )
   o. 5 students and more ( )

10. Is English used as a medium language in the office?
    c. Yes ( ) b. No ( )
    If **no**, please specify your medium language _______________________________________

Thank you for taking the time to complete the questionnaire. Your kind attention and cooperation is highly appreciated.

Appendix 10 – Syllabus for PBL in Case Study 1

The table below outlines the modules that make up for the programme in Case Study 1.

No	Semester	Module Name	Credit	Total Contact Hours	Lecture	Tutorial	Practical	PBL
1	1	Computer & Programming	3	90	25	21	21	23
2		Electrical Principles	3	90	40		40	10
3		German Language 1	2	36	18	12		6
4		Pre-Calculus	3	54	10	32		12
5		Engineering Science	2	36	16	11		9
6		Effective Communication Skills	2	36	15			21
7		Technical Drawing & CAD	2	72	18		54	
8	2	Electronics	3	90	39		44	7
9		Technical English 1	2	36	4	10		22
10		German Language 2	2	36	25			11
11		Electronics Workshop	3	90	15		75	
12		Calculus	3	54	26	14		14
13		Basic Engineering Materials	2	36	26			10
14		Basic Metal Work	2	72	18		54	
15		Pengajian Malaysia 2	3	54	35	19		
16	3	Sensor & Transducer	3	90	16		64	10
17		Electrical Machines & Control	3	90	18		72	
18		Digital Systems	3	90	36		38	16
19		Technical English 2	2	36		12		24

20		Pneumatics & Hydraulics Technology	3	90	38		52	
21		Machine Elements	2	72	32		16	24
22		Dinamika Islam Di Malaysia /	2	36	20			16
23		Co-Curricular Activities & Community Services	2	40	8	2		30
24		Power Electronics & Modern Drive Technology	2	72	24		38	10
25		Electrical Installation	2	72	21	5	46	
26		Basic Turning & Milling	3	108	20		80	8
27	4	Programmable Logic Controllers	3	90	17		64	9
28		Machine Design	2	72	30		34	8
29		MEC Project Proposal	2	54				54
30		Industrial Management	2	36	18			18
31		Control Systems Application	3	90	18		46	26
32	5	Industrial Training	8					
33		Industrial Robotics	2	72	18		39	15
34		Computer Integrated Manufacturing	2	72	15		46	11
35	6	MEC Final Project	4	54				54
36		Entrepreneurship	2	36	23	12		1
37		Microcontroller	2	72	16	4	44	8
38		Basic Engineering Metrology	2	54	12		34	8
			98	2380	730	154	1001	495
					30.67%	6.47%	42.06%	20.80%
					37.14%		62.86%	

Appendix 11 – Syllabus for WBL in Case Study 2

The table below outlines the modules that make up for the programme in Case Study 2.

No	Semester	Module Name	Credit	Total Contact Hours	Lecture	Tutorial	Practical	WBL
1	1	English At the Workplace	2	45	15		30	
2		Advanced Engineering Mathematics	3	45	45			
3		Advanced Power Electronics	3	60	30		30	
4		Biomedical Signal Processing	3	60	30		30	
5		Physiology for Engineers 1	3	60	30		30	
6	2	TITAS	2	45	15		30	
7		Biomedical Sensor and Transducer	3	45	15		30	
8		Embedded Computer Network	3	45	15		30	
9		Electromagnetic Field Theory	2	45	45			
10		Physiology for Engineers 2	3	45	15		30	
11	3	Hospital & Maintenance Management	2	30	30			
12		Management – Imaging Equipment	3	90				90
13		Maintenance – General Biomedical Equipment	3	130				130
14		Technical Assessment Report	2	60				60
15	4	Maintenance - Critical Care Equipment	3	120				120
16		Maintenance - Laboratory Equipment	4	160				160
17		Engineering Improvement	3	60				60
			47	1145	285	0	240	620
					24.89%	0.00%	20.96%	54.15%
					24.89%		75.11%	