Using an eportfolio to enhance graduate attributes among engineering students in Malaysia

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DECLARATION

I declare that this dissertation is my own account of my research and contains as its main content work which has not previously been submitted for a degree at any tertiary education institution.

Signed:

Date:
ABSTRACT

The broad context for this study is that all Malaysian public and private universities must incorporate graduate attributes into their curriculum from August 2006. Graduate attributes have received increasing attention over recent years as universities incorporate these attributes into the curriculum. Graduates who have adequate technical knowledge only are not sufficiently equipped to compete effectively in the work place; they also need non-disciplinary skills, graduate attributes. Assessing student achievement of the attributes is therefore important and eportfolios have the potential to enhance graduate attributes.

This study therefore fills a research gap by investigating the impact of embedding an eportfolio into a technical communication course for engineering students. The study examines the learning process and uses the students’ voice to test the assertion that eportfolios may contribute to enhancing graduate attributes: communication skills, critical thinking and problem solving skills, and teamwork skills. The key research question to be explored is: To what extent does the use of an eportfolio enhance students’ communication skills, critical thinking and problem solving skills, and teamwork skills? This study examines the learning process in developing an eportfolio by adapting the Plan-Do-Review cycle (Pallister, 2007). An investigation is conducted which focuses on students’ perceptions of the value of the eportfolio to their learning and its potential to promote key graduate attributes among engineering undergraduates. The research was conducted in one of the universities in Malaysia.

This study uses a mixed methods research approach where a qualitative research approach, called a ‘case study’, formed the methodological framework of this investigation. The case study incorporated a number of data gathering techniques,
including two questionnaires: preferred and actual, five focus group interviews with five
students in each group, an interview with the lecturer, classroom observation and
document analysis of student blog entries and reflection entries. These data were used to
analyze students’ learning outcomes, experiences and perception of the use of eportfolio
in enhancing the communication, teamwork, and critical thinking and problem solving
in the course. A total of 66 students participated in this research.

The students claimed that eportfolio has enhanced the following graduate attributes:
communication skills, critical thinking and problem solving skills, and teamwork skills.
They reported that they improve their interpersonal communication, reflection, and
collaboration with their peers. They learn from reflecting on their artifacts,
collaborating, and interacting with their peers.

Findings from this study reveal that most of the students’ expectations have been met
with their actual learning. They show that students become more motivated and active
when constructing their eportfolios. The Plan-Do-Review model is very useful, as the
students use it as a guide to construct and develop their eportfolios in the course: they
plan, collect, select, review, and share their artifacts in their eportfolios. The positive
learning experiences enable the students to be actively engaged in constructing their
eportfolios and learn to be reflective, collaborative, and communicative with their peers.
They also discover their strengths, improve on their weaknesses, and learn to set goals
for their learning.

This investigation indicates the potential of an eportfolio. The study offers research-
based recommendations to enhance graduate attributes with an eportfolio.
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GLOSSARY

Artifact


Blog

Blood (2002) stated that a blog is a hypertext product that enabled people to post or publish their thoughts and get feedback in the form of links and memos from people in a collaborative way. Blogs have advanced from simple online personal diaries to a technology that allows people to engage in collaborative activity, knowledge sharing, reflection and debate (Brooks, Nichols, & Priebe, 2004; Walker, 2005).

Eportfolio

Eportfolios are known as electronic portfolio, ePortfolio, e-portfolio, efolio, digital portfolio, or webfolio, and can be classified in different ways by different people (Barrett, 2001; Truer & Jenson, 2003). Barrett (2000) stated that an eportfolio uses electronic technologies to enable students to gather and arrange artifacts in many media types such as audio, video, graphic, or text, and later reflect on what they have learnt (Fernsten & Fernsten, 2005; Gallagher, 2001; Gathercoal, Love, Bryde, & McKean, 2002; Holtzman & Dagavarian, 2007) and examine the strengths and areas for improvement regarding how they learned these new skills (Ury, & McFarland, 2001).

Graduate attributes

Graduate attributes are the set of qualities and skills predetermined by a university that students should develop and acquire from the institution which later contribute to their career (Bowden, Hart, King, Trigwell, & Watts, 2000), which are also known as soft skills in Malaysia (Ministry of Higher Education, Malaysia, 2006). These skills include communication skills, teamwork skills, critical thinking and problem solving skills, ethical moral and professional skills, entrepreneurial skills, life-long learning and information management skills and leadership skills (Shakir, 2009).
CHAPTER 1  INTRODUCTION TO THE STUDY

What is the Issue?

Graduate attributes have received increasing attention in Malaysia (Rahman, Mokhtar, Mohd Yasin, & Mohd Hamzah, 2011; Shakir, 2009) and internationally, including Australia (Birrell, 2006; Engineers Australia, 2005; Love & Cooper, 2004; Maiden, 2004; Tosh, Light, Fleming, & Haywood, 2005); the United States of America (Baxter & Young, 1982; Christy & Lima, 1998; Engineering Accreditation Commission, 2003; Rogers & Williams, 1998) and the United Kingdom (Association of Graduate Recruiters, 2006; Bennett, Dunne, & Carre, 1999; Dickinson, 2000; EPC Assessment Working Group, 2002; The Engineering Professors Council, 2000). This role of graduate attributes has been highlighted particularly in higher education for over a decade (Barrie, 2006; Curtis & McKenzie, 2001; McKell, Reynolds, Longenecker, Landry, & Pardue, 2004; Sumsion & Goodfellow, 2004), and these graduate attributes are also important for government, employers, society and students and curriculum developers (Barrie, 2005).

Graduate attributes are the set of qualities and skills predetermined by a university that students should develop and acquire from the institution which later contribute to their career (Bowden et al., 2000), which are also known as soft skills in Malaysia (Ministry of Higher Education, Malaysia, 2006). These skills include communication skills, teamwork skills, critical thinking and problem solving skills, ethical moral and professional skills, entrepreneurial skills, life-long learning and information management skills, and leadership skills (Shakir, 2009).

The issue has been highlighted globally as undergraduates lack graduate attributes demanded by the job market in Malaysia (Kamsah, 2004; Shakir, 2009) and
internationally (Bennett et al., 1999; Dickinson, 2000; Maiden, 2004). Graduates who have adequate technical knowledge only are not sufficiently equipped to compete effectively in the workplace; they also need non-disciplinary skills, especially graduate attributes (Callan, 2003; Kemper, 1999; McMurchie, 1998; Spenser & Spenser, 1993). Graduate attributes complement hard skills, which are the technical requirements of a job (Bancino & Zevalkink, 2007; Bennett, 2002; Kemper, 1999; McMurchie, 1998). Spenser and Spenser (1993) shows that better-quality performers need both hard skills and graduate attributes for successful performance (Ashton, 1994; Caudron, 1999).

On the national agenda, in the 9th Malaysian Plan as envisaged by the Prime Minister of Malaysia, is the development of human capital (Ninth Malaysian Plan 2006-2010, 2006). The concern about the quality of the graduates from institutions of higher learning in Malaysia was discussed in this document. One of the agenda items is graduates who are generally academically proficient but lack in graduate attributes, such as communication and analytical skills, demanded by employers. This statement is supported by Ramlee (1999) who carried out a research and found technical graduates in Malaysia has equipped themselves with technical skills but failed to convince the employers as they lacked motivational skills, communication skills, interpersonal skills, critical thinking, problem solving, and entrepreneurship skills. Therefore, the institutions of higher learning are urged to produce graduates who are well rounded with quality attributes abovementioned quality attributes (Salih, 2008). The aspirations of the higher education institutions in Malaysia are to produce graduates who are not only competent with content but also equipped with the necessary non-technical attributes. This is to ensure that the new graduates are able to fulfil the demands of industry. Engineering students develop technical knowledge in order to be certified as engineers but they also need additional, broader attributes in the workplace (McCowan &
Competent engineers should have a balance of non-technical competency of skills and attributes along with technical competency (Nguyen, 1998; Tong, 2003). These graduate attributes include oral and written communication skills, teamwork skills, critical and creative thinking skills, and problem-solving methods (Hassim, Abd. Hamid, Abu Hassan, Mohd. Yusof, Syed Hassan, & Esa, 2004).

Engineers need these attributes in order to fulfil the demand of their employers. Lee and Tan (2003) claimed that the important deficiencies identified in Malaysian engineering graduates were interpersonal communication, project planning or scheduling, people management, problem solving, and team management. The researcher believes that graduate attributes can play an important role in shaping engineering students to become more effective and be better prepared to enter the workforce. This chapter discusses how teaching graduate attributes has been implemented in Malaysia and how graduate attributes among the engineering students in Malaysia might be enhanced.

**Background to the Study**

The increasing rate of unemployed graduates in all areas has posed a major concern for Malaysian higher education gatekeepers and stakeholders. The Economic Planning Unit (EPU) in Malaysia reported that there were 60,000 Malaysian graduates were unemployed in 2005 (The Star, 2005). Unemployment among graduates according to universities (Appendix A) and Unemployment among Malaysian graduates according to courses (Appendix B) show the high rate of unemployment among graduates according to universities and courses in Malaysia.

The rate of unemployment of graduates shows that there is a need to address this critical issue. Graduates lack the skills of presentation and communication and therefore they
were not able to impress employers during interviews (Samuel & Baker, 2008; Vijan, 2007). This statement was further confirmed in a survey in a study of employment conducted by the National Economic Action Council, where 115 employers listed down the top three graduate attributes needed from the graduate: good communication, being presentable and having a good grasp of general knowledge (Ahmad, 2005). Malaysian universities are also reported as not producing work-ready graduates because their education system is too exam-oriented (The Star, 2004). They produce graduates who are competent technically but lack graduate attributes. Another reason is related to the mismatch between what the universities are producing and what the Malaysian job-market seeks (Asma & Lim, 2000; Kanapathy, 2001; Lee, 2000; Quek, 2000; Vijan, 2007; Yogeeswaran, 2005). Graduates were unemployed not because they were not competent but rather because they lacked graduate attributes that have been neglected in the educational system (Lee, Quek, & Chew, 2001; Quek, 2000; Sibat, 2005; Singh, 2001). This is because prior to 2006 graduate attributes were not incorporated into the university curriculum in Malaysia.

Surveys showed that employers were looking for graduate attributes rather than technical knowledge (Mitchell, 2003). Empirical studies on employment found that graduate attributes such as oral and written skills (Jacobsen, 1993; Lee et al., 2001; Quek, 2005; Schroder, 1989; Tong, 2003), teamwork (Boud & Middleton, 2003; Kanapathy, 2001; Quek, 2005), interpersonal and leadership skills (Lee, 2000; Quek, 2005) and entrepreneurial interest are important for recruiting and promoting employees to main positions (Audibert & Jones, 2002). A study carried out by Clarke (1997) showed that graduates should equip with graduate attributes such as communication, teamwork, initiative, problem solving and decision making in order to make themselves more employable. Thus, graduate attributes are necessary to contribute to the
organizational success in the workplace for all staff (Bunker & Wakefield, 2004; Muir, 2004; Somerset, 2001).

A report by the World Bank (2007) claimed that there was a relationship between the workplace and university education. Findings from the Tracer Study of Graduates (2006) and commissioned research (Ministry of Higher Education, Malaysia, 2004) stressed that higher education institutions should embed graduate attributes including language, teamwork, and problem solving, into the curriculum. This is because these skills are considered to be the most critical skills in the recent global job market especially in a fast-moving era of technology (Ministry of Higher Education, Malaysia, 2006).

The idea of embedding graduate attributes into the curricula of public and private universities was announced in August 2006 by the Ministry of Higher Education, Malaysia. The former Higher Education Minister, Datuk Mustapa Mohamed, stated that the module was introduced after taking into consideration feedback from employers that local graduates lacked graduate attributes, resulting in unemployment (Asma & Lim, 2000; Kanapathy, 2001; Lee, 2000; Quek, 2000) and that universities need to embed these skills into their respective courses. Besides, there should also be links from faculty to industry and students should be given career skills development through job placements in the private sector, as well as career counselling. These measures should address the problems of the initial transition of fresh graduates into the employment sector.

Engineering students have been found to lack communication and teamwork skills (Mills & Treagust, 2003). Lee and Tan (2003) noted that the important deficiencies
identified in Malaysian engineering graduates were interpersonal communication, project planning/scheduling, people management, problem solving, and team management, and this has also been a concern for the researcher’s university. The faculty deans have voiced their concerns to their lecturers and have argued that effective measures need to be taken to address the matter. The researcher’s experience in Malaysian universities also confirms that students’ lack of skills affects their ability to plan, select, review, and present their ideas in their assignments. The university can play an important role in ensuring that engineering students have acquired the required graduate attributes. This is supported by the Newsletter of the Quality in Higher Education Project, of the University of Central England, Birmingham, (QHE, 1994), cited in Bennett et al. (1999), which reported that higher institutions play an important role in ensuring undergraduates are equipped with the necessary competencies that prepare them to work successfully in organisations. This is important because industries and employers have become more demanding and want engineers to have better oral and written communication skills, teamwork skills, and critical thinking and problem solving skills. Graduate attributes complement hard skills can therefore play an important role in enabling engineering students to become more effective engineers and be better prepared to enter the workforce.

**Problem Statement**

While eportfolio use has risen prominently over the past few years, and many teachers support the notion that it fosters the development of graduate attributes, it is not yet possible to say that it is a widely accepted approach within most professional worlds, especially in the field of engineering, for either teachers or students. Some universities in Malaysia have used various approaches such as problem-based learning (PBL) (Adnan, Wan Abdullah, & Jusoff, 2009), project oriented problem-based approach
(POPBL) and project-based approach (Idrus, Mohd Dahan, & Abdullah, 2010) to achieve their graduate attributes. One approach that has the potential to be useful to enhance graduate attribute is the eportfolio.

Eportfolios can improve learning; however, the process of learning using eportfolios has not been thoroughly researched and there is therefore little evidence to support existing claims (Ayala, 2006; Hartnell-Young & Morriss, 2007; Tosh et al., 2005). While much research has been carried out on how learning can be improved with eportfolios, this research has generally involved the distribution of surveys and polls to students, and also elicited responses from users on the efficacy or value of eportfolios. Interviews have been conducted to seek the perceptions of individuals such as instructors, institutional leaders and programme managers who implemented the eportfolio tool for instruction and assessment in higher education. Findings from previous studies do not explicitly reveal how the students’ learning benefited as a result of using the eportfolios. Articles in the literature revealed about student learning that dependent on the perspective of lecturers or researchers who present their beliefs about what is going on (Acker, 2005; Barrett & Carney, 2005; Cambridge, Kahn, Tomkins, & Yancey, 2001; Jafari & Kauffman, 2006; Tosh et al., 2005; Yancey, 2001; Zubizaretta, 2004). There is a dearth of literature focused on developing insight into students’ experiences and voices in constructing and using eportfolios (Jafari & Kauffman, 2006; Stefani, Mason, & Pegler, 2007; Zubizaretta, 2004). Similarly, Wagner and Lamoureux (2006, p. 541) supported the lack of student voices in eportfolio research, noting that

While a considerable body of literature details the merit and implementation of eportfolios, research designed to elicit feedback from the primary constituents - student and faculty – is limited.

Researchers such as Paulson, Paulson, & Meyer (1991) and Ring & Foti (2003) have recommended that, when students are allowed an active voice in presenting evidence
regarding their accomplishments, they assume personal ownership over improvement.

The eportfolio must be fully embedded into the curriculum as it cannot simply be used as an add-on (Evans, Hawes, & Shain, 1999; Paulson, Paulson, & Meyer, 1991).

According to Zubizaretta (2004, p. 4),

> Often...what is left out of the formula in student portfolios in an intentional focus on the learning piece, the deliberate and systematic attention not only to skills development but also to a student’s self-reflective, meta-cognitive appraisal of how, and more importantly, why learning has occurred.

Barrett (2008) carried out a research study on year K-12 students for 24 months. This study of ‘Reflect Initiative’ investigated the impact of eportfolios on student learning, motivation and engagement in secondary school. The study involved 3,000 secondary students at 26 different schools in eight states. The result revealed that the research team was unable to address the question due to the short period of time. Furthermore, the findings were limited as the methodology failed to include students’ exact remarks about their personal experiences of constructing and using the eportfolio.

A further review of the literature on eportfolios confirms the need for more research that incorporate student voices. As Ayala (2006, p. 12) states,

> Since 2000 over 300 articles have appeared on the topic of electronic portfolios. E-portfolios are described as the panacea for potentially problematic issues ranging from student learning to standards, advising, job hunting and assessment. Many of the benefits associated with electronic portfolios are described as improving student learning. In reality, very few studies include student viewpoints. Of 300 articles I reviewed, fewer than 15 (5%) used students’ voices to illustrate student concerns and needs. Student issues and concerns involve promoting student learning. When articles did mention students, electronic portfolios were done unto them and not them. As for the learning benefits associated with electronic portfolios, more than two thirds of the articles I reviewed focused primarily on assessment and accountability issues. I would argue that the knowledge promoted under the guise of electronic portfolios is hardly student-centred. Very little research exists on integrating student voices into the dialogue of electronic portfolios. The voices that are integrated are primarily those of administrators and faculty. To date, no discussions mentioning student-centred pedagogy or student development theory have infiltrated the discussion on electronic portfolio development.
This study therefore fills a research gap by investigating the impact of embedding an eportfolio into a technical communication course. The study examined the learning process and used the students’ voice to test the assertion that eportfolios might contribute to more effective learning in terms of communication skills, critical thinking and problem solving skills, and teamwork skills. An investigation was conducted which focused on students’ perceptions of the value of the eportfolio to their learning and its potential to promote prominent graduate attributes among engineering undergraduates. The research was conducted in one of the universities in Malaysia and gathered both qualitative and quantitative data to answer the research questions.

**Purpose of the Study**

The purpose of the study is to examine aspects of student learning processes when students use the eportfolio in the course. The possible enhancement of graduate attributes, particularly communication skills, critical thinking and problem solving skills, and teamwork skills, is the focus of this research. Eportfolio is an excellent way to foster the student-centred environment, and to store and organize student work. The use of eportfolio offers students an authentic way to demonstrate their accomplishments and allows them to take responsibility for their own work (Lankes, 1995). The current literature on eportfolios strongly advocates that the learning theories of constructivism have an important role in shaping the potential of the eportfolio as a tool to enhance student learning. Bransford, Brown, and Cocking (2000, p. 10) contended that “[the] contemporary view of learning is that people construct new knowledge and understandings based on what they already know and believe”. The authors further noted that constructivism occurs when individuals engage in a generative process of thinking about their thinking. Three of the undergraduate engineering accreditation bodies in Australia (Engineers Australia, 2005), the USA (Christy & Lima, 1998;
Rogers & Williams, 1998) and the UK (EPC Assessment Working Group, 2002) identified student eportfolios as one possible strategy for demonstrating programme outcomes and student attainment of graduate attributes. Specifically, the objectives of this research study are to examine if and how an eportfolio enhances students’ graduate attributes; in particular:

(i) communication skills

(ii) critical thinking and problem solving skills

(iii) teamwork skills

**Research Questions**

The research questions which guided the investigation are:

To what extent does an eportfolio enhance students’ graduate attributes; in particular:

(i) communication skills?

(ii) critical thinking and problem solving skills?

(iii) teamwork skills?

**Theoretical Framework**

Constructivism is a theory of learning or meaning making in which “individuals create their own new understandings on the basis of an interaction between what they already know and believe and ideas and knowledge with which they come into contact” (Richardson, 2003, pp. 1623-1624). In constructivism, learning is regarded as a personal interpretation of the world, as learners create interpretations of the world based on their past experiences and interpretations (Duffy & Cunningham, 1996; Jonassen & Henning, 1999; Wilson, 1995). In the constructivist form of learning, students become active, critical, reflective, take more responsibility for their own learning and learn to construct knowledge on their own and determine their own learning outcomes. A number of
Theorists have supported that learners construct their own knowledge (Bruner, 1986; Smagorinsky, 2001; Steinberg & Kincheloe, 1998; Vygotsky, 1978).

Constructivism is concerned with the process of how we construct knowledge, which depends on what learners already know, which in turn depends on the kinds of experiences they have had, how they have organized those experiences into knowledge structures, and the learners’ beliefs that are involved when interpreting the events in the world (Jonassen, 1995, p. 42). This learning theory represents the philosophical underpinnings of, and offers guidance for, the content and design of eportfolio. The advantages of constructivism are that it provides student-centred activities in the learning process, which enables students to participate in their learning process and become autonomous and independent. In such an activity, student-centred learning can be encouraged as the students will engage in collaborative activities with their team members, as well as with the lecturer, who acts as a facilitator supporting the students in their learning process, facilitating social interactions and communication between students, and encouraging collaborative and cooperative learning (Orlich, Harder, Callahan, & Gibson, 1998). By working in a group situation, students will need to tap into their group skills and use a variety of activities to accomplish the project’s overall objectives. The group would be responsible for their goals and students learn to solve problems and work collaboratively. Learning takes place in a meaningful, authentic context and is a social, collaborative activity, where peers play an important role in encouraging learning (Herrington, Oliver, Reeves, & Woo, 2004). Besides, deep learning can occur during the process of learning and this constitutes reflection, development, integration, self-direction and life-long learning (Barrett & Wilkerson, 2004). As Zubizaretta (2004, p. 15) states,

The essential purpose of the eportfolio is to improve student learning by providing a structure for students to reflect systematically over time on the
learning process and to develop the aptitudes, skills and habits that come from critical reflection.

However, the author does not provide any empirical evidence to support this claim. A review of the literature on eportfolios (Acker, 2005; Barrett & Carney, 2005; Cambridge et al., 2001; Jafari & Kaufman, 2006; Moon, 1999; Stefani et al., 2007; Tosh et al., 2005; Yancey, 2001) further supports the lack of empirical evidence on the eportfolio as a tool that supports learning by providing a structure for continual reflection.

This study examines the learning process in developing an eportfolio by adapting the Plan-Do-Review cycle (Pallister, 2007), as shown in Figure 1.1. This cycle incorporates both the approaches of Kolb’s Experiential Learning Cycle (Kolb, 1984) and Action Learning (McGill and Brockbank, 2004), as outlined in Pallister (2007). These two approaches are based on constructivist learning principles (Jonassen, 1994).
Review and reflect on artifacts

Figure 1.1 The eportfolio process as a 'Plan–Do-Review’ cycle (adapted from Pallister, 2007)

Kolb’s Experiential Learning Cycle is a model for understanding how the process of learning works; it draws on experiential education principles, which are largely based on the educational philosophy of John Dewey. This position asserts that students will be motivated and have more valuable learning experiences if they encounter positive experiences, and likewise, negative experiences will deter students from potentially useful experiences in the future. McGill and Brockbank (2004, p. 11) defined action learning as a continuous process of learning and reflection that occurs with the support of a group or set of colleagues working on real problems with the intention of getting things done.

Pallister’s Plan-Do-Review model underpins a social constructivist approach to learning. This cycle involves student-centred learning and the students have to become active, critical and reflective in their learning and take responsibility for their learning.
It fosters authentic learning when students are placed in the centre of the learning process, and actively engage in constructing eportfolios and gain the experience of the learning by planning, selecting, reflecting, and sharing the artifacts. Eportfolio is based on the constructivism paradigm; students create knowledge through the activities when developing their eportfolios (Abrami & Barrett, 2005; Chang, 2001; Klenowski, Askew, & Carnell, 2006; Meeus, Questier, & Derks, 2006; Strudler & Wetzel, 2005). Stefani et al. (2007) suggest that the potential for eportfolios to support learning is linked to a student’s ability to play an important role in its development.

Traditionally, the teacher assumed the role of the source of knowledge or the only content expert in the class and taught using the directed instruction method. In this teacher-centred approach, the teacher is in control of the information and is solely responsible for how much information is to be delivered to the students, creating a one-way interaction in the teaching and learning environment. The traditional ‘chalk-and-talk’ approach to teaching is practiced by many higher institutions of learning; however, recently, there has been a change towards creating a constructivist learning environment in the institutions (Oliver, 1998; Oliver, 2000). Here, the lecturer acts as a facilitator with the aim of helping students achieve their learning objectives rather than the director of instruction. From a constructivist perspective, students must be provided with a rich learning environment. The computer, with its capability of processing and integrating the various media elements such as text, graphics, sound, animation, and video, is ideally suited to present such an environment. The success in its creation is dependent on three factors: the role that the teacher plays; the role the student plays; and the use of technology in cultivating this learning environment. Thus instruction focuses on assisting learners to develop learning and thinking strategies in the subject domain, that is, learning ‘how to learn’ rather than how much is learned (Mayer, 1998). In this
process, the student takes the role of the active learner rather than of the passive learner (Dana & Tippins, 1998; Jonassen, 1991; Vonderwell & Turner, 2005).

In this student-centred learning approach, the students must play an active part in their learning and construct their own knowledge or meaning of what they learn, and their learning also builds on what they have already constructed in other contexts. The students determine how to reach the desired learning outcomes themselves. In other words, students are involved in learning as a process of knowledge creation and not knowledge absorption. This learning process occurs when students use their current knowledge to construct new knowledge (Orlich et al., 1998). Technology can be used by the lecturers to represent and support their educational materials. In this research study, the students are free to choose the artifacts and information to be included in their eportfolio. Therefore, eportfolio has the potential to offer new insights into the students’ learning process that enables the construction of new information and knowledge.

**Scope of the Study**

This study concentrates on the development of an eportfolio as a learning process in a technical communication course over one semester by a class of engineering undergraduates at a university in Malaysia. The evaluation of its effectiveness in the enhancement of graduate attributes, particularly communication skills, critical thinking and problem solving skills, and teamwork skills will be investigated. Barchfeld (1997) has stated that eportfolio has the potential to change the approach to education. Thus, the students’ perspectives on them need to be explored. The data collected include written reflections by the students.
Significance of the Study

The proposed research is important because no study on the effect of the use of eportfolio on graduate attributes has been carried out in the Malaysian higher education sector. This research has collected authentic data from the voices of the students as evidence to test the assertion that an eportfolio can enhance graduate attributes in terms of communication skills, critical thinking and problem solving skills and teamwork skills. Based on the literature (Barrett, 2005; Dibiase, 2002; Huba & Freed, 2000; Jafari, 2004; Linn & Gronlund, 2000; Williams & Jacobs, 2004; Winder, 2006), the researcher believes that using eportfolios has great potential for university lecturers, who want to embed technology in the university course. The testing 'Plan-Do-Review’ cycle in Figure 1.1, adapted from Pallister (2007) can contribute to our knowledge base in relation to the application of enhancing learning, and is particularly valuable for other researchers who want to incorporate eportfolio into their study, or for practitioners who wish to embed eportfolio into their practice.

Review

This study investigates whether an eportfolio embedded into a technical communication course can enhance students’ graduate attributes, particularly communication skills, critical and problem solving skills, and teamwork skills. Students perceptions were sought to allow the voices of the participants to add to the literature in order to answer the research objectives of the study. This study will therefore contribute to our understanding of the benefits of eportfolio as a tool to enhance graduate attributes.
CHAPTER 2 SIGNIFICANCE OF GRADUATE ATTRIBUTES

What are Graduate Attributes?

In the Malaysian context, graduate attributes are known as *soft skills* that incorporate the cognitive elements associated with non-academic skills, which include the cluster of personality traits, social graces, language proficiency, personal habits and teamwork (Ministry of Higher Education, Malaysia, 2006). Graduate attributes are also known by a number of terms and interpretations in various overseas countries (see Table 2.1).

Bowden et al. (2000) define these as follows,

> Graduate attributes are the qualities, skills and understandings a university community agrees its students should develop during their time with the institution. These attributes include but go beyond the disciplinary expertise or technical knowledge that has traditionally formed the core of most university courses. They are qualities that also prepare graduates as agents of social good in an unknown future.

<table>
<thead>
<tr>
<th>Term</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core skills, key skills, common skills</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>Essential skills</td>
<td>New Zealand</td>
</tr>
<tr>
<td>Key competencies, employability skills, generic skills, graduate attributes</td>
<td>Australia</td>
</tr>
<tr>
<td>Employability skills</td>
<td>Canada</td>
</tr>
<tr>
<td>Basic skills, necessary skills, workplace know-how</td>
<td>United States</td>
</tr>
<tr>
<td>Critical enabling skills</td>
<td>Singapore</td>
</tr>
<tr>
<td>Transferable skills</td>
<td>France</td>
</tr>
<tr>
<td>Key qualifications</td>
<td>Germany</td>
</tr>
<tr>
<td>Trans-disciplinary goals</td>
<td>Switzerland</td>
</tr>
<tr>
<td>Process independent qualifications</td>
<td>Denmark</td>
</tr>
</tbody>
</table>

*Source: National Centre for Vocational Education and Research (NCVER) 2003*

The issue of graduate attributes in higher education has increasingly gained attention in related educational literature (Barrie, 2004; Fallows & Steven, 2000; Hager & Holland, 2006; Johnston & Watson, 2006; Knight & Yorke, 2004; Scanlon, 2006). Graduate attributes constitute more than skill components, attitudes, values and dispositions.
(Hager & Holland, 2006). This is because graduate attributes seem to be linked to sets of key skills (Fallows & Steven, 2000), transferable skills, or generic skills (Allen Consulting Group, 1999). Barnett (2006, p. 61) however believes that graduate attributes “should not primarily be construed as sets of skills or even knowledges but should be viewed as certain kinds of human dispositions and qualities”. Students need to have a balance of technical and non technical attributes. The higher education sector and business community are showing an interest in graduate attributes (Hager, Holland, & Beckett, 2002, p. 2):

The term ‘generic skills’ is used widely to refer to a range of qualities and capacities that are increasingly viewed as important in higher education. These include thinking skills such as logical and analytical reasoning, problem solving and intellectual curiosity; effective communication skills, teamwork skills and capacities to identify, access and manage knowledge and information, personal attributes such as imagination, creativity and intellectual rigour and values such as ethical practice, persistence, integrity and tolerance.

In Australia in general, there are four broad graduate attributes such as problem solving, critical thinking, interpersonal understanding and written communication. At Murdoch University, there are nine attributes such as communication, critical and creative thinking, social interaction, independent and lifelong learning, ethics, social justice, global perspective, interdisciplinarity, and in-depth knowledge of a field of study. Beside this, there are also sub-attributes identified for each attributes. These attributes mirror an Australia-wide movement for all universities to define their graduate attributes, to demonstrate how they are integrated into the curriculum and to enhance these attributes in students during their undergraduate degree.

**Discussion on the Issues of Graduate Attributes**

The issue of undergraduates who lack graduate attributes is actively discussed internationally, including Australia (Birrell, 2006; Engineers Australia, 2005; Love & Cooper, 2004; Maiden, 2004; Tosh et al., 2005); the United States (Baxter & Young,
1982; Christy & Lima, 1998; Rogers & Williams, 1998) and the United Kingdom (Association of Graduate Recruiters, 2006; Bennett et al., 1999; Dickinson, 2000; EPC Assessment Working Group, 2002). A finding from a biannual survey by the Association of Graduate Recruiters in the United Kingdom showed that employers found that graduates are lacking in graduate attributes such as communication skills as well as verbal and numerical reasoning skills, even though they performed well academically (Association of Graduate Recruiters, 2006). Surveys of employers reported that they wanted graduates equipped with graduate attributes, particularly oral and written skills (Jacobsen, 1993; Lee et al., 2001; Schroder, 1989), teamwork (Boud & Middleton, 2003; Kanapathy, 2001), and interpersonal and leadership skills (Lee, 2000). Graduates must be able to demonstrate teamwork, problem-solving, and how to handle non-routine tasks; they must be decisive, responsible, and communicate effectively (Australian Chamber of Commerce and Industry & Business Council of Australia, 2002; Field, 2001; Hager et al., 2002). Similarly, America is also experiencing the same problem when research studies on employers show an emphasis on graduate attributes (Dearing Committee, 1997), such as basic communication, thinking and problem solving skills, and teamwork skills (United States of Department of Labor, 2000).

A review on engineering education in Britain and Australia by several authors concluded that the courses failed to supply graduates with the needed skills by the industry and governments (Finniston, 1980; Johnson, 1996; Wearne, Pugh, Eley, Uemura, Vaags, & Solem, 1984; Williams, 1988). Engineering education should encourage engineer students equipped with problem-solving, communication, teamwork, self-assessment, change management and lifelong learning skills (Rugarcia, Felder, Woods, & Stice, 2000).
This is also true for Malaysian graduates where employers have complained that these graduates lack the necessary graduate attributes vital for work such as communication, problem solving, and team work skills (New Straits Times, 2004). The local newspapers (Ahmad, 2005; Overseas Graduates, 2007) reported that in recent years, there has been an increased focus by all universities on graduate attributes. Graduates lacked the graduate attributes demanded by the society and job market (Asma & Lim, 2000; Kanapathy, 2001; Lee, 2000; Quek, 2000). This is confirmed by Deputy Human Resources Minister Datuk Abdul Rahman Bakar who claimed the lack of graduate attributes is a major problem faced by some 90,000 graduates who seek employment in Malaysia (Overseas Graduates, 2007). The idea of embedding graduate attributes into the curricula of public and private universities was announced in August 2006 by the Ministry of Higher Education, Malaysia (2006), and universities are required to embed these skills into their respective courses.

Why are Graduate Attributes Important?

The increasing rate of unemployed graduates has posed a major concern for Malaysian higher education gatekeepers and stakeholders. Employers in Malaysia have discovered that graduates lacked graduate attributes such as communication, problem solving and team work skills demanded by society and the job market (New Straits Times, 2004). This is confirmed in a survey in a study on unemployment conducted by the National Economic Action Council in Malaysia where 115 employers listed the top three graduate attributes required from graduates as good communication skills, being presentable and having a good grasp of general knowledge (Ahmad, 2005). Several authors agreed that graduates were not unemployed because they were not intelligent but rather due to a lack of graduate attributes, attributes that have been neglected in the educational systems (Lee et al., 2001; Quek, 2000; Sibat, 2005; Singh, 2001). The
graduates’ learning programmes did not contain these graduate attributes in the curriculum prior to 2006. Thus, institutions of higher learning are urged to instil the highly valued graduate attributes in their graduates through their courses in order for them to balance in intelligence, and demonstrate excellent attitudes and high ethical and moral values.

A report from Malaysia and the Knowledge Economy: Building a World-Class Higher Education System (2007) claimed that there was a relationship between the workplace and university education. Findings from the Graduate Tracer Study (2006) and commissioned research (Ministry of Higher Education, Malaysia, 2004) stressed that tertiary education institutions should embed graduate attributes (language, team work, and problem solving) into the curriculum. This is because these are considered to be the most critical skills in the recent global job market particularly in the fast moving era of technology (Ministry of Higher Education, Malaysia, 2006). Graduates were also probed on ten dimensions of the preparation for work in their current work, addressing items such as the adequacy of their specific course training, graduate attributes, teamwork, communication skills and their facility in using computers. Neo and Neo (2002, p. 142) states,

There is a need to devise curriculum so that the culture of ‘learning to learn’ and lifelong learning can be rapidly inculcated into the students. The learning content must foster the skill to seek information, think critically, use the information and communicate effectively and work in a team.

The university plays an important role in ensuring that graduate attributes are embedded into the engineering curriculum. There is a need to instil the values of graduate attributes into our engineering students as industries and employers have become more demanding in expecting engineers to possess better oral and written communication skills, teamwork skills, and critical thinking and problem solving skills. Thus, graduate attributes play an important role in shaping the engineering students to become more
effective engineers, as these graduates possess high expertise in both technical and
graduate attributes and competencies they will indeed be better prepared to enter the
working world.

What are the Steps Taken by Malaysian Universities and Faculty to Embed
Graduate Attributes into the Curriculum?
The local newspapers (Ahmad, 2005; Overseas Graduates, 2007) reported that over
recent years, there has been an increased focus by all Malaysian universities on graduate
attributes. The initial step taken by the Malaysian government to address the issue of
lack of graduate attributes in undergraduates was the standardization and
implementation of the Finishing School programme in all public universities. Some
public universities in Malaysia have implemented activities in the programme such as
extra English classes every weekend to improve students’ language proficiency and
three modules of training for public sector executives, corporate /industry executives
and entrepreneurial executives. The activities were mostly student-centred, where
discussions, simulation, role-play and presentations are emphasized. This was followed
by the implementation of the graduate attributes modules for all undergraduates in
public universities, commencing from the 2006/07 intake, authorized by Higher
Education Minister, Datuk Mustapa Mohamed, in order to prepare undergraduates for
the world of work by taking into consideration complaints from employers of students’
lack of graduate attributes. The graduate attributes module was prepared by academics
and officers from Malaysia public universities, and the graduate attributes skills were
embedded into these modules with the aim being to generate graduates to be critical and
analytical thinkers, and to possess high self-esteem. The graduate attributes are imparted
through assignments, course work and tutorials, and cut across the curriculum (Overseas
Graduate, 2007).
Other efforts to improve higher education by the government include: reviewing academic programmes with private sector input, incorporating graduate attributes in the curricula, offering programmes on entrepreneurship, double majors, and structured career counselling services (cited in Human Development Sector Reports East Asia and the Pacific Region the World Bank (March 2007). Furthermore, Malaysian universities have taken initiatives in offering academic programmes with the necessary support and resources, integrating these skills into curriculum and course design, offering undergraduates industrial training (work placements) and exposure to professional settings, fieldwork, or providing advice and guidance through counselling career services. Finally, the universities provide opportunities for students to develop graduate attributes through participation in clubs, games, and societies. All these efforts are designed to enhance graduate attributes among undergraduates.

All Malaysian public and private universities must incorporate graduate attributes into their curriculum from August 2006 (Ministry of Higher Education, Malaysia, 2006). A holistic approach is used to plan and implement the teaching of graduate attributes among higher education students. This includes a combination of several programmes and main activities, such as formal teaching and learning activities (including all curricular and co-curricular activities), support programmes (academic and non-academic) and the students’ campus life (students’ residences and the campus surroundings) (Ministry of Higher Education, Malaysia, 2006).

A Model for Implementing Graduate Attributes in Higher Education

Figure 2.1 shows the framework for implementing the graduate attributes among students of higher institutions in Malaysia. In general, the development of graduate
attributes among students via the formal teaching and learning activities is based on two models: stand alone and embedded.

![Diagram showing Development of Graduate Attributes Among Students of Higher Institutions]

**Figure 2.1** Model for implementation of graduate attributes among students of higher education. Ministry of Higher Education, Malaysia (2006)

**Stand alone subject model.** This model uses the approach of training and providing opportunities for students to develop graduate attributes through specific courses that are carefully planned for this purpose. Usually, these subjects are offered as university courses (such as English language, Islamic civilization, and entrepreneurship) and elective courses (such as public speaking, and critical thinking). The courses in this category are often a part of the overall requirements that make up the programme. The number of courses and credits in this category depends on the curriculum design and the requirements of the programme. The stand alone subject model can also be initiated by
encouraging students to sign up for several additional courses which can be accumulated to comprise a minor course which is different from the initial programme for which students signed up. For example, a student who is pursuing an engineering programme is encouraged to take minor courses in management or mass communication. However, such an approach will require an increase in the number of credits and time spent completing the particular programme.

**Embedded model.** This model uses the approach of embedding the graduate attributes in the teaching and learning activities across the curriculum. It does not require the student to take special courses, as in the stand alone subject model. Instead, the students are trained to master the graduate attributes through various formal teaching and learning activities that are planned and carried out using specific strategies and methods. In this way, the content and learning outcomes to be achieved for the respective courses are maintained. The learning outcomes related to the graduate attributes will be integrated and be part of these learning outcomes. This is the preferred model to be implemented in all courses for the various programmes in institutions of higher learning. Each element of the graduate attributes is spelled out in the learning outcomes and then translated into the instructional plan for the semester. This is followed by implementing several teaching and learning activities such as questioning, class discussion, brainstorming, team work, presentation, role play and simulation, task or project, field work, and site visits.

In general, the development of graduate attributes using the embedded model requires the expertise of lecturers in using the various teaching strategies and methods that are entirely student-centred. It also involves active teaching and learning, and students should actively participate actively in the activities. Some of the appropriate strategies
and methods that are practical include learning by questioning, cooperative learning, problem-based learning, and e-learning.

Combination of stand alone subject model and embedded model. Each of the respective models described above has its weaknesses and strengths. From the framework, planning, implementing and assessment, the stand alone model is definitely at an advantage. This is because the course or subject is specially developed to assist students to acquire the graduate attributes. However, this model lacks the opportunity for students to develop and acquire graduate attributes as integrated with other knowledge and skills in the major discipline studied. The existing number of credits for the respective programme is also a constraint for students to sign up for additional courses on graduate attributes.

On the other hand, the framework, planning, implementation, and assessment of the embedded model are more challenging than for the stand alone model. This model requires lecturers to master specific teaching and learning skills and then apply these skills in teaching the respective core courses for the specific programme. However, when the appropriate teaching and learning strategies are carefully planned and used, this model is more effective in developing and acquiring the graduate attributes as they are integrated with the other forms of knowledge and skills in the programme. Moreover, this model does not require any courses additional to the already existing courses of the respective programme.

Based on the strengths and weaknesses discussed, higher education institutes are encouraged to use the embedded model as compared to the stand alone model, given that, the embedded model focuses on student-centred learning such as experiential
learning and problem-based learning, and provide students with practical experience as well.

**Development of graduate attributes through support programmes.** The development of graduate attributes through support programmes involves programmes and activities that are created, developed and used to support graduate attributes either directly or indirectly. In general, programmes and activities can be divided into academic support programmes and non-academic support programmes. The academic support programme is designed to help students acquire the graduate attributes that are associated with academic matters. Some of these programmes include learning skills and an English language support programme (ELSP).

Non-academic support programmes assist students to acquire the graduate attributes that are not related to academic matters but relate to the personality and professional development of the students. Most of the programmes and activities are co-curricular and extra co-curricular.

**The development of graduate attributes through campus life activities.** Most of the university students spend half of their students’ life living in residences on the university campus. As such, institutions of higher learning should use this valuable opportunity to develop their graduate attributes. This can be done by organising crafted programmes and activities such as dramas, debates, and singing competitions, all of which can be carried out in the campus vicinity.
How are the Graduate Attributes Embedded into the Higher Education Curriculum in Malaysia?

According to the Ministry of Higher Education, Malaysia (2006), all institutions of higher learning in Malaysia have implemented seven graduate attributes into the curriculum. These are communication skills, thinking skills and problem solving skills, team work force, life-long learning and information management, entrepreneurial skills, ethics, morals and professionalism, and leadership skills. Each of the graduate attributes is comprised of several sub-skills which are divided into two categories of implementation. The first category describes the graduate attributes that every individual must have (i.e. essential) and the second category represents graduate attributes that are good to have (i.e. desirable). Emphasis is on the graduate attributes that must be present, but the student is also encouraged to inculcate them that are good to have which are additional graduate attributes and a bonus to the student. All elements of graduate attributes that have been suggested by the Ministry of Higher Education, Malaysia must be acquired by each individual student and evaluated effectively and comprehensively. Table 2.2 provides a detailed description of the different categories of implementation for each of the sub-attributes of the seven graduate attributes.
Table 2.2: The seven graduate attributes and their elements

<table>
<thead>
<tr>
<th>Graduate Attributes</th>
<th>Must Have Elements</th>
<th>Good To Have Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Sub-Attributes)</td>
<td>(Sub-Attributes)</td>
</tr>
</tbody>
</table>
| (i) Communication Skills | • Ability to deliver information clearly, effectively and confidently through written and oral forms.  
• Ability to actively listen and respond to the ideas of others.  
• Ability to make a clear and confident presentation to the audience. | • Ability to use technology during a presentation.  
• Ability to discuss and arrive at a consensus.  
• Ability to communicate with individuals from a different cultural background.  
• Ability to expand one’s own communication skills.  
• Ability to use non-oral skills. |
| (ii) Critical Thinking and Problem Solving Skills | • Ability to identify and analyse problems in difficult situations and make a justifiable evaluation.  
• Ability to expand and improve thinking skills such as explanation, analysis, and evaluate discussion.  
• Ability to find ideas and look for alternative solutions. | • Ability to think beyond.  
• Ability to make a conclusion based on valid proof.  
• Ability to withstand and give full responsibility.  
• Ability to understand and accommodate oneself to the varied working environment. |
| (iii) Team Work | • Ability to build a good rapport, interact and work effectively with others.  
• Ability to understand and play the role of a leader and follower alternatively.  
• Ability to recognize and respect other’s attitude, behaviour and beliefs. | • Ability to contribute to the planning and coordinate group work.  
• Responsibility towards group decision. |
| (iv) Lifelong Learning & Information Management Skills | • Ability to find and manage relevant information from various sources.  
• Ability to receive new ideas to learn autonomously. | • Ability to develop an inquiring mind and seek knowledge. |
| (v) Entrepreneurship skills | • Ability to identify job opportunities. | • Ability to propose business opportunity.  
• Ability to build, explore and seek business opportunities and job.  
• Ability to be self-employed. |
| (vi) Ethics, Moral & Professional skills | • Ability to understand the economic crisis, environment and social cultural aspects professionally.  
• Ability to analyze and make problem solving decisions related to ethics. | • Ability to practice ethical attitudes besides having responsibility towards society. |
| (vii) Leadership skills | • Knowledge of the basic theories of leadership.  
• Ability to lead a project. | • Ability to understand and take turns as a leader and follower alternatively.  
• Ability to supervise members of a group. |

**Communication Skills**

Students are expected to be fluent and communicate effectively in both the *Bahasa Malaysia* (national language of Malaysia) and English language in different contexts and with different people. There are eight sub-attributes under communicative skills of which three are the *must have* skills and five are the *good to have* skills. As graduates, they must be able to express their thoughts clearly and confidently in oral and written forms. Graduates should also be able to deliver a good presentation with the help of technology (Ministry of Higher Education, Malaysia, 2006).

**Critical Thinking and Problem Solving Skills**

Graduates should have the ability to think critically, creatively, innovatively, and analytically. This also involves the ability to apply knowledge and understanding to new and different problems. Graduates must able to apply their knowledge and critical thinking skills, skills to organize and interpret data and information, skills to formulate questions, and the ability to analyse (Ministry of Higher Education, Malaysia, 2006).

**Teamwork Skills**

These skills involve the ability to work with people from different social cultural backgrounds to achieve a common goal. Students are encouraged to play their role in the group and to respect the opinions and attitudes of others in the group. They are also expected to contribute to the group’s plan and coordinate the group’s effort besides being responsible for the group’s decision (Ministry of Higher Education, Malaysia, 2006).
Lifelong Learning and Management of Information

These skills involve an effort to learn to be independent or self-regulated in acquiring skills and new knowledge. Graduates must be able to find and manage relevant information from various sources. Lifelong learning will enable graduates to accumulate much knowledge and skills over the years. The ability to manage information well will allow a graduate to distinguish between good and bad, to adopt the best practices and to make sound decisions (Ministry of Higher Education, Malaysia, 2006).

Entrepreneurship Skills

These skills involve the ability to seek business opportunity and develop risk awareness, to be creative and innovative in activities related to business and tasks to design and plan business propositions, and the ability to be self employed. This attribute can in some ways contribute to the eportfolio if the training and practice is conducted for a good purpose (Ministry of Higher Education, Malaysia, 2006).

Ethics, Moral, and Professional Skills

These skills incorporate the ability to practice a high moral standard in professional tasks and social interaction and also include the ability to analyse ethical problems and make problem solving decisions. Graduates must have a sense of responsibility towards society (Ministry of Higher Education, Malaysia, 2006).

Leadership Skills

These skills include the ability to lead in various activities and tasks. It is also important to lead in discussion and make decision (Ministry of Higher Education, Malaysia, 2006).
What are the Steps taken by the researcher’s University and Faculty to Embed Graduate Attributes into the Curriculum?

The integration of graduate attributes into the university’s engineering curriculum provides one solution for training and preparing the undergraduates with the necessary transferable hard (technical) and graduate (non-technical) attributes to transfer from the classroom to the workplace. Engineering graduates possessing a high proficiency in both technical and graduate attributes will indeed be better prepared to enter the working world.

The researcher’s university has embedded the seven graduate attributes into the curriculum. Each faculty will choose to embed these graduate attributes into individual courses which are known as units in Australia. The researcher’s faculty has chosen three graduate attributes, namely communication skills, critical thinking and problem solving skills, and teamwork skills to be embedded into the technical communication course. This is due to the fact that these three graduate attributes have been chosen and agreed by all faculties to be embedded into the technical communication course and other. The other four graduate attributes will be embedded into other courses by other faculties in the university: therefore, the seven graduate attributes will be embedded into the syllabus by the respective faculties.”
Listed below is the translated version of the detailed explanation of the three graduate attributes adopted by the researcher’s department.

Table 2.3: Graduate attributes adopted by the researcher’s faculty into the technical communication courses

<table>
<thead>
<tr>
<th>Communication skills (CS)</th>
<th>Teamwork skills (TS)</th>
<th>Critical thinking and problem solving skills (CTPS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C S 1</td>
<td>T S 1</td>
<td>C T P S 1</td>
</tr>
<tr>
<td>The ability to present ideas clearly, effectively and confidently in oral and written forms (Kebolehan menyampaikan idea dengan jelas, berkesan dan dengan penuh keyakinan, secara lisan dan bertulis)</td>
<td>The ability to develop good relationships, and interact and collaborate effectively to achieve the common goal (Kebolehan membina hubungan baik, berinteraksi dengan orang lain dan bekerja secara efektif bersama mereka untuk mencapai objektif yang sama)</td>
<td>The ability to identify and analyse problems in a complex situation and make a justification (Kebolehan mengenal pasti dan menganalisa masalah dalam situasi kompleks dan kabur, serta membuat penilaian yang berjustifikasi)</td>
</tr>
<tr>
<td>C S 2</td>
<td>T S 2</td>
<td>C T P S 2</td>
</tr>
<tr>
<td>The ability to practice active listening and respond appropriately (Kebolehan mengamalkan kemahiran mendengar yang aktif dan memberi maklum balas)</td>
<td>The ability to understand and take turns being a leader and follower in a group (Kebolehan memahami dan mengambil peranan bersilah ganti antara ketua kumpulan dan ahli kumpulan)</td>
<td>The ability to expand and improve thinking skills such elaboration, analysis and discussion evaluation (Kebolehan mengembang dan membaiki kemahiran berfikir seperti menjelaskan, menganalisa dan menilai perbincangan)</td>
</tr>
<tr>
<td>C S 3</td>
<td>T S 3</td>
<td>C T P S 3</td>
</tr>
<tr>
<td>The ability to present confidently in a way that caters to the audience level (Kebolehan membuat pembentangan secara jelas dengan penuh keyakinan dan bersesuaian dengan tahap pendengar)</td>
<td>The ability to understand and respect each member (Kebolehan mengenali dan menghormati sikap, kelakuan dan kepercayaan orang lain)</td>
<td>The ability to find ideas and find alternative solutions (Kebolehan mencari idea dan mencari penyelesaian alternative)</td>
</tr>
</tbody>
</table>

Source: Kementerian Pendidikan Tinggi, Malaysia (2006)

The three graduate attributes, namely communication skills, critical thinking and problem solving skills, and teamwork skills had been chosen by the department to be embedded into the technical communication courses.
**Communication Skills**

Communication is defined as “the ability to communicate effectively and appropriately in a range of contexts using communication, literacy, numeracy and information technology skills” (Murdoch University, 2003). Communication is a process of conveying meaning in an attempt to create shared understanding and requires interpersonal skills in order to process, listen, observe, speak, question, analyse, and evaluate. This requires two-way interactive communication where negotiation of meaning occurs (Phillips, 2008) and students can share ideas, information, opinions and feelings with their peers and instructor by commenting on each other’s work. The feedback will enhance the process of communication when the students use it to improve their work.

**Interpersonal communication.** The researcher chose interpersonal communication as it is listed as the most important attribute for a graduating engineer to possess, since employers considered this attribute as necessary for an engineer to conduct negotiations, participate as a member of a team, interact with various types and levels of people, serve and meet customers’ expectations, practise good listening skills to work well with a wide variety of people and resolve conflicts maturely. This is supported by the study carried out by Tong (2003), which found that engineers needed to possess interpersonal communication skills. The author also noted that employers want their employees to be able to follow clear instructions as well as to give them to speak clearly, deliver successful presentations and produce effective reports.

**Critical Thinking and Problem Solving Skills**

Critical thinking and problem solving skills are important to engineering students as when a problem occurs and engineers need to think critically and through reflection,
they will find the best solution. Critical thinking has been defined as “involving the ability to explore a problem, question or situation; integrate all the variable information about it; arrive at a solution or hypothesis; and justify one’s position” (Warwick & Inch as quoted in Petress, 2004, p. 461). Fisher and Scriven (1997, p. 21) defined critical thinking as “skilled and active analysis and evaluation of observation and communications, information and argumentation”. Engineers are expected to learn to observe, analyse, and communicate to create new products and resolve problems related to existing products. Whenever engineers are thinking creatively and critically about ways to increase the quality of life, they are constantly involved in the process of critical thinking and problem solving. A lack of formal education in thinking and engineering problem solving means that trial and error is the most widely used approach in day-to-day engineering work.

Students develop critical thinking skills, problem solving and team skills, experiential learning and interdisciplinary knowledge, with technology integrated into their learning (Cook & Cook, 1998; Oliver, 2000). This also represents a shift from traditional education towards students being active participants in the learning process (Oliver, 1998).

Reflection. Reflection is an attribute of critical thinking and problem solving skills. Moon (2005, p. 1) defined reflection as,

Reflection is a form of mental processing that we use to fulfill a purpose or to achieve some anticipated outcome. It is applied to gain a better understanding of relatively complicated or unstructured ideas and is largely based on the reprocessing of knowledge, understanding and possibly emotions that we already possess.

Dewey (1933) defined reflective thinking as careful consideration and examination of issues of concern associated to an experience. It is also a review of personal and
professional life experiences, skills discovery, qualities, and knowledge resulting from and documenting the learning experience. Students create their own meaning through reflection that focuses on how real knowledge and information fit into the broader conceptual models or existing knowledge that they have (Bransford et al., 2000). They also learn to apply reflective thinking to their experiences, and generate meaning and discover their own learning through collaboration with, and feedback from, their instructor (Lynch & Purnawarman, 2004).

**Teamwork Skills**

Teamwork skills refer to “competencies that individual team members must possess in order to perform the necessary teamwork behaviours” (Beaubien & Baker, 2004). Therefore, good teamwork will develop good relationships, where students interact and collaborate effectively to achieve a common goal, understand and take turns in being a leader and follower in a group, and understand and respect each member of the team.

**Collaboration.** Collaboration is defined as “a cooperative endeavour that involves common goals, coordinated effort, and outcomes or products for which the collaborators share responsibility and credit” (Austin & Baldwin, 1992, p. 1). Educators have claimed that collaboration is an effective way for students to learn and collaboration creates constructive effects in student learning (Bruffee, 1999; Crook, 1994; Johnson & Johnson, 2004; Uribe, Klein, & Sullivan, 2003). According to Panitz (1996), collaborative learning is a learning method where each members of a group can contribute their capabilities and share the authority and responsibility. Scholars have noted that collaborative learning is the construction of shared understanding through interaction and problem solving with others (Crook, 1994). It is also an instructional method that encourages students to work together with their peers (Keynes, Hiltz, &
Benbunan-Fich, 1997). Conversation, reflection, and negotiation of meaning are important activities in collaborative learning. Students are not only expected to find a solution to a problem, but also to explain and justify their developing ideas to others. This approach for students learning has been well documented, with benefits such as student achievement, problem solving, and motivation (Crook, 1994).

In face-to-face education, collaborative learning involves more than simply putting students in groups. Effective peer learning is dependent on the task and on the creation of group goals and group organisation, where the students are dependent on each other in order to solve a problem (Arvaja, Etelapelto, Hakkinen, & Rasku-Puttonen, 2003). Furthermore, a task that requires problem solving and high-level interaction should be given to students (Arvaja et al., 2003).

Collaboration is an important and integral component of the learning process where the student seeks out more experienced people to help solve the task and, in doing so, obtains knowledge and experience he or she would not otherwise have had if acting individually (Hardy, Lawrence, & Grant, 2005). Scaffolding will then become an important aspect to constructivist learning as older, more experienced students and lecturers become "scaffolds" who help and support individual students in a task and guide them until they reach a sufficient competence level (Collis, Winnips & Moonen, 2000; McLoughlin, 1999; Winnips & McLoughlin, 2001). The collaborative activities with others enable students to develop varieties of ideas, where a form of ‘shared reality’ is produced (Jonassen, 2000), and this helps a student to hold "...varying and discrepant points of view with which to consider the merits of his or her own mental models" (Oliver, 2000).
Review

The growing emphasis on graduate attributes in higher education has posed a global concern and the issue of undergraduates who lack graduate attributes has been highlighted in the literature. Several steps have been taken by Malaysian universities and faculty to embed graduate attributes into the curriculum. It is important to help students to achieve graduate attributes and variety strategies and methods have been used in Malaysian universities. These include learning by problem-based learning (PBL) (Adnan et al., 2009), project oriented problem-based approach (POPBL) and project-based approach (Idrus et al., 2010) to achieve graduate attributes. One approach that has the potential to be useful in order to enhance graduate attributes is the eportfolio. Love and Cooper (2004) and three undergraduate engineering accrediting bodies in Australia (Engineers Australia, 2005), USA (Christy & Lima, 1998; Rogers & Williams, 1998) and the UK (EPC Assessment Working Group, 2002) have identified eportfolios as one of the possible approaches to help student attainment of graduate attributes.
CHAPTER 3     HOW EPORTFOLIO CAN SUPPORT
GRADUATE ATTRIBUTES

Eportfolio as an Added Tool in Learning

Many higher education institutions have implemented the eportfolio tools into individual courses, departments, schools, and across institutions to exhibit evidence of more authentic student work, show student progress over time, and represent collections of best artifacts (Cambridge et al., 2001; Walz, 2004). Students are able to construct new ideas based on their current or prior knowledge in order to make learning effective as self-regulation is being emphasized for the 21st century university student (Boekaerts, 2002). Eportfolio complements and builds on recent developments within e-learning such as the move to social computing, blogs and wikis. Online connectivity is transforming the practice of learning so that it is more student-centred and outcome oriented (Barrett, 1999; Rennie & Mason, 2004).

What is a Portfolio?

According to the National Education Association (1993, p. 41), a portfolio is “a record of learning that focuses on the student’s work and his reflection on that work”. The work includes student participation in choosing the artifacts, determining the criteria for selection, setting the criteria for judging merit and showing evidence of student self-reflection (Northwest, 1990). Wade, Abrami, and Sclater (2005) defined portfolio “as a purposeful collection of student work that tells the story of a student’s effort, progress and/or achievement in one or more areas”. Winsor and Ellefson (1995, p. 68) define the portfolio as,

A thoughtful, organised and continuous collection of a variety of authentic products that document a professional or student’s progress, goals, efforts, attitudes, pedagogical practices, achievements, talents, interests and development over time.
The portfolio emerged only in the late 1980s in educational circles in the works of Paulson and Paulson (1994). The term ‘portfolio’ derives from the Latin verb *portare*, meaning to carry, and the Latin noun *foglio*, meaning sheets or leaves of paper (Chappell & Schermerhorn, 1999). The portfolio, described as the ‘next step’ in student assessment, is a great tool for exhibiting a student’s efforts, progress, and achievement, and is being adopted by numerous engineering faculties in the United States. The process of accreditation and quality assurance in engineering and technology programmes has been initiated by the Accreditation Board for Engineering and Technology (ABET) in the United States in 2001. The countries involved were the United States, Australia, Canada, the United Kingdom and New Zealand. Countries such as South Africa, Japan, Malaysia, Singapore and Germany joined later (Washington Accord, 2004). Engineering education’s current interest in using portfolios of student work has been driven by its adoption by the Accreditation Board for Engineering and Technology’s Engineering Criteria 2000 in the United States, in which portfolios are mentioned as one means of documenting and assessing student outcomes (Rogers & Williams, 1998). Similarly, other undergraduate engineering accreditation bodies in Australia (Engineers Australia, 2005) and the United Kingdom (EPC Assessment Working Group, 2002) also proposed eportfolios. This is because an engineer who displays his or her eportfolio of work enables the reader to form a direct impression of the work immediately (Abrami & Barrett, 2005). Thus, graduates can maintain an eportfolio that contains examples and highlights of their works so that they can present them to their prospective employers.

Olson (1991, p. 73) stated that the initial definition for a portfolio was defined as portable case for carrying loose papers or prints, ‘port’ meaning to carry and ‘folio’ pertaining to pages or sheets of paper. Today, portfolio is classified with reference to a
large collection of materials such as documents, pictures, papers, work samples, audio or videotapes. Knapper (1995) reported that the main idea of a portfolio is very simple and could be described by the conventional way that a creative artist assembles samples of ‘best work’ for presentation and review. Traditionally, it was a way to present a variety of information describing an individual’s education and achievements. Starting in the early 1990s, the eportfolio began to take over the portfolio and develop new forms (Karsenti, Villeneuve, & Goyer, 2007).

**What is an Eportfolio?**

Eportfolios are known as electronic portfolios, ePortfolios, e-Portfolios, efolios, digital portfolios, and webfolios, and can be classified in different ways by different people (Barrett, 2001; Truer & Jenson, 2003). The eportfolio is presented as “simply electronic versions of physical portfolios that include digital objects rather than physical objects. They are classified as the new generation of the old three-ring binder” (Stefani et al., 2007, p. 17).

However, these variations tend to be more related to uses and purposes than to essential features. Barrett (2000) stated that an eportfolio uses electronic technologies to help students to gather and arrange artifacts in many media types such as audio, video, graphic, and text, and later reflect on what they have learnt (Fernsten & Fernsten, 2005; Gallagher, 2001; Holtzman & Dagavarian, 2007), and to examine the strengths and areas for improvement about how they learned these new skills (Ury, & McFarland, 2001).

Lorenzo and Ittleson (2005, p. 2) define eportfolios as:

A valuable learning and assessment tool. An eportfolio is a digitized collection of artifacts including demonstrations, resources and accomplishments that
represent an individual, group or institution. This collection can be comprised of text-based, graphic or multimedia elements archived on a Web site or on other electronic media such as a CD-ROM or DVD. An eportfolio is more than a simple collection - it can also serve as an administrative tool to manage and organize work created with different applications and to control who can see the work. Eportfolios encourage personal reflection and often involve the exchange of ideas and feedback.

According to Barrett (2000, p. 15), eportfolios are:

[those that make] use of electronic technologies that allow the portfolio developer to collect and organize artifacts in many formats (audio, video, graphics, and text). A standards-based electronic portfolio uses hypertext links to organize the material to connect artifacts to appropriate goals or standards... An electronic portfolio is not a haphazard collection of artifacts (i.e., a digital scrapbook or multimedia presentation) but rather a reflective tool that demonstrates growth over time.

What is the Difference between Traditional Portfolios and Eportfolios?

Many benefits gained from the construction and use of the traditional form can justifiably be attributed to the electronic version as the eportfolio is very much of an evolution of the traditional portfolio (Strudler & Wetzel, 2005). Some of the advantages of eportfolios compared with traditional portfolios are discussed in turn below.

Storage Space

Traditional portfolios have always being bulky and difficult to transport. Students do not have to invest in bulky storage systems and can access their eportfolios from anywhere. Their lecturers can also access the eportfolios and check on the students’ learning processes online. An eportfolio allows a relatively large amount of material to be stored and shared in a cost effective way, either physically on a CD or DVD, or online (Corbett-Perez & Dorman, 1999; Keller, 2006). Furthermore, eportfolios can store multiple media. Students' writing as well as samples of oral reading, a three-dimensional model, artwork, sketch, or animation may be easily collected and stored on the computer. This is interesting because, for example, a student of can incorporate a
three-dimensional model into his or her eportfolio while designing, creating and
demonstrating a mechanism, especially Computer Assisted Drawing (CAD) for
engineering students.

**Data Types**
Eportfolios can contain not only text data but also material such as audio files, video
files and slide presentations of CAD. Therefore, the electronic format makes it more
convenient and cheaper to maintain it rather than convert it into paper format (Heath,
2002).

**Adaptability and Flexibility**
Another advantage of eportfolios is that they are more accessible than paper-based
portfolios. It is easy for artifacts to be added, deleted, edited or rearranged as compared
to a traditional portfolio. The artifact does not have to be arranged or read in a linear or
hierarchical structure (Chappell & Schermerhorn, 1999). Also, this tool is easy to be
upgraded and the content of eportfolios may be updated from time to time as the student
progresses through the term. The versatility of eportfolios permits lecturers and students
to choose from a wider range of options for inclusion (Bergman, 2000).

**Audience Access**
If the eportfolio is hosted on a web site it provides easy access to the stakeholders or
readers or audience that have been granted access. Alternatively, the artifacts can be
easily transferred and copied onto CD-ROM and then distributed. The eportfolios
enable easy distribution and use, and the opportunity for the viewer to select what to
view (Riggsby, 1995). This also opens the way for more immediate feedback from a
wider range of sources (Abrami & Barrett, 2005; Ahn, 2004; Lorenzo & Ittleson, 2005).
The eportfolio tool may also allow different arrangements of the artifact to be seen depending on the ‘access’ given to the audience. For example, it is possible for different prospective employers to see different artifacts or hide artifacts from view. This can enhance the notion of lifelong learning for students, who can take charge of their own learning.

Why Eportfolios?

Eportfolios are collections of students’ work that may be stored in many formats (audio, video, graphics, and text) on CD-ROM or a diskette which allows students to share their work with a larger audience, offers authentic assessment tools, and motivates and contributes to their language development. An eportfolio is known as a digital container which stores visual and auditory content including text, images, video, and sound. It is also a learning tool because students can organize content and can reflect on information about their learning, thus it is designed to support many pedagogical processes and assessment purposes. It can be constructed as a process in which the eportfolios can support the user’s learning through embedded structures and strategies. It is considered to be a personal learning management tool where it encourages individual improvement, personal growth and development and commitment to lifelong learning (Arter & Spandel, 1992; MacIsaac & Jackson, 1994).

The use of technology can be a motivating factor for the use of eportfolios because students can engage artifacts in their learning and are able to express their own voice in their eportfolios (Barrett, 2004). An eportfolio could serve as a web-based digital repository of artifacts designed to display and demonstrate the student’s knowledge and performance (Greenberg, 2004). According to Wilkerson and Lang (2003), eportfolios are excellent tools for reinforcing learning and for making formative and summative
decisions about learners’ knowledge, skills, dispositions and growth. Growth and learning are clearly important attributes of a quality instructional technology programme. A survey of employers conducted in 2008 at the Association of American Colleges and Universities showed that thirty five percent of them would like to have the evidence of students' work in eportfolios when recruiting college graduates (Hart Research Associates, 2009).

**Engineering Education and Eportfolio**

According to Campbell and Schmidt (2004), eportfolios and other assessments of student achievement are becoming important issues in engineering education. Good communication is defined by some engineering departments in terms of writing manuals and evaluating the number of grammatical errors in a document. Therefore, the assessment of effective communication should involve discovering what constitutes communication besides having good grammar and correct spelling and the ability to evaluate engineering communication. The students are able to include visuals such as diagrams, charts, pictures and graphs. For example, charts are used to illustrate design procedures and to help students organize their thinking.

Engineering education’s current interest in using portfolios of student work has been driven by the adoption of the Accreditation Board for Engineering and Technology’s Engineering Criteria 2000 in the United States, where students will be able to demonstrate the ‘ability to communicate effectively’. Eportfolios are stated as one method for collecting artifacts on students’ learning and accomplishments as criteria for engineering students’ learning and assessing student outcomes. Nevertheless, the problems in the United States are similar in Malaysia, despite the differences in culture and environment. Therefore, engineering students of colleges and technical institutes in
Malaysia need to be equipped with adequate instructional tools such as eportfolio as it allows the students to create and own their personal website for storing and managing their tasks, such as individual and group assignments as well as samples of a three-dimensional model, artwork, a sketch, or an animation into multiple media. This was interesting because engineering students could incorporate a three-dimensional model into their eportfolios while designing, creating and demonstrating a mechanism especially by utilising the CAD software. The engineering undergraduates have learned the use of CAD, which is the use of computer technology to design, draft, and display of graphically oriented information. CAD allowed the students to create, visualize, and document their ideas clearly and efficiently in a visual (drawing) and symbol-based method of communication, the conventions of which are particular to a specific technical field.

Moreover, the students also learned about animation, modelling and other multimedia in their engineering courses. The development of quality computer graphics was important in order to present visual ideas clearly. For example, three-dimensional animated computer graphics were especially useful in simulating real situations in semi-immersive virtual reality. Therefore, the eportfolio will allow the students to utilise their skills and knowledge of CAD and multimedia in demonstrating the real simulation in an interesting way. As engineers, the researcher suggested that students needed to be equipped with the eportfolio as a tool to help them to be more creative and design authentic tasks, and present them clearly to the intended audience, who could be their lecturers, peers, employers, and the public.

Furthermore, students can easily upgrade the content of eportfolios and update from time to time as they progress through the semester, where they can keep track of their
cours, projects and reflect on their assignments and their development as engineers. Besides, students are able to connect their educational experience and present their skills and talents as engineers when they use their eportfolios to showcase these in the interview.

**Potential Benefits of Eportfolios**

There are many cited advantages of eportfolios in the literature, such as an increase in the technological knowledge and skills; facility in distribution; the capacity to store many professional documents; increased accessibility; the achievement of authentic learning; and the collection of graduate attributes evidence (Barrett, 2005; Cambridge et al., 2001; Hallam, Harper, McCowan, Hauvile, McAllister, & Creagh, 2008; Lorenzo & Ittleson, 2005; Love & Cooper, 2004; Olson, 1991; Rogers & Williams, 1998; Tosh et al., 2005; Williams & Sher, 2004; Yancey, 2001). Olson (1991) stated that the initial definition for an eportfolio was a portable case for carrying loose papers or prints, ‘port’ meaning to carry and ‘folio’ pertaining to pages or sheets of paper. The current eportfolio is classified as a large collection of materials such as documents, pictures, papers, work samples, audio or videotapes. Knapper (1995) reported that the key idea of an eportfolio is very simple and could be described by the conventional way that a creative artist assembles samples of ‘best work’ for presentation and review.

**Potential Benefits of Eportfolios for Students**

*Opportunities to increase learning benefits.* Eportfolios are claimed to present many benefits for students who want to create and reflect on life experiences, and types of eportfolio and their learning benefits have received attention in the literature (Acker, 2005; Barrett, 2000; Barrett & Carney, 2005; Cambridge et al., 2001; Gulbahar & Tinmaz, 2006; Jafari & Kauffman, 2006; Karsenti, Goyer, Villeneuve, & Raby, 2007;
Tosh et al., 2005; Yancey, 2001). This web-based tool provides a place for undergraduate engineering students to display and reflect on their engineering achievements, and to personalize their eportfolio. This enables the students to learn, develop, and display their strengths (Abrami & Barrett, 2005; Anderson, 2005; Keller, 2006). The tool also provides a forum for the students to reflect on their coursework and their development as future engineers. This will benefit the students as this will give them a clearer picture of how their studies fit into the realm of engineering.

Eportfolios could also provide opportunities for students to develop a deeper awareness of themselves and their abilities. This can be done through reflecting on and recording their experiences, which will enable them to recognise and review the knowledge and skills they have developed as a result of those experiences. Therefore, a learning plan can be constructed to guide the students’ learning process and professional development (Challis, 1999). Importantly, it should be a part of student-owned or student-centred approach to learning where it is possible for students to be actively involved in their learning rather than merely being the receiver of information (Tosh et al., 2005).

Eportfolios appear to offer this opportunity for learner control and to be capable of supporting or promoting deep learning as students are able to make connections between the learning which occurs in different contexts: academic, workplace and community. If students do not accept the eportfolio as a tool to document their learning or refuse to use eportfolio in their course, then the potential impact of eportfolio on stakeholders will not be realised. Also, the literature suggests that student engagement is a very important element of eportfolio development (Barrett, 2000; Yancey, 2001).

**Opportunities to enhance technological skills.** During four years of undergraduate education engineering, students will produce a variety of materials that
are indicative of their knowledge and skills. The current digital technology in the form of an eportfolio enables storage and presentation of such materials in an easy to create and easy to access format. Students could also use and bring their eportfolios to interviews to show to their prospective employers. This is because eportfolios are evidence of the collection of skills and attributes that the students have gathered over the duration of the study. By using hypertext links, students can present and explore much documentary information in a way that reinforces the notion of learning as a shared, interactive process, inviting both the portfolio student and target audience progressively deeper and wider into the constructed process of learning. Eportfolio projects can publicize student’s work online which is known as the ‘social action’ and ‘interactivity’ of learning (Yancey 2001, p. 20). Furthermore, they will able to use the artifacts documented in the eportfolio to answer any interview questions and respond to the selection criteria. Therefore, the eportfolios serve as a valuable tool for their career development.

Opportunities for lifelong learning and employment. Students will also be engaging in developing their eportfolios as a part of lifelong learning and retaining, synthesizing, and relating conceptually complex information in significant results (Lambert & McCombs, 1998). The students can determine an order of storage but could change the content and display of the eportfolios according to the needs of the target audiences. For example, a lecturer and a prospective employer will have different expectations and perspectives of the portfolio. Thus, students could edit, copy, paste, undo and collate to suit these different needs and contents by changing the layout or template or appearance of the same content in digital form. Research on student engagement with learning reveals that when students are given the choices to learn the subject matter, they are more motivated to learn more and gain a deeper understanding.
of the subject (Entwistle, 1998; LaSere Erickson & Weltner-Strommer, 1991; Ramsden, 2003).

**Potential Benefits of Eportfolios for Faculties**

**Opportunities to evaluate curriculum or programme effectiveness.** The eportfolio can be used by the departments and faculties to seek feedback and results of the effectiveness of the curriculum or the academic programme offered (Mason, Pegler, & Weller, 2004). Some potential opportunities for the host institution that adopts an eportfolio programme for students have been discovered (Gathercoal, Love, Bryde, & McKean, 2002; Lorenzo & Ittleson, 2005; Nickelson, 2004). These include assisting with student transition, offering an insight into student progression through a specific course or in general, offering the opportunity for dynamic course feedback from students, helping to support work placements, showcasing student achievement that can demonstrate the success of the institution, and encouraging institutional reflection (Dhir, 2005; Jafari, 2004; Popper, 2005). The information can also be used to increase students’ engagement with their own learning. The eportfolio can also be used as a tool to measure the Programme Outcomes (PO) and Learning Outcomes (LO) for the academic programmes. The faculty can utilize the results from the feedback to improve the quality of teaching and learning.

**Opportunities to collect accreditation materials.** The eportfolio system benefits the faculty through the collection of accreditation materials. Niguidula (1993) stated that viewing a student’s progress through the eportfolio provides a ‘richer picture’ of student learning. Reflection plays an important role as students are able to present their interests and skills through the artifacts they created on the website, but also in conversation with recruiters and faculty, thus it can provide a richer picture of
student work through document growth over time. Stiggins (1994, p. 87) added that a portfolio is “a means of communicating about student growth and development”. This reflective aspect of the eportfolio system can facilitate the advising process between faculty and students when students provide valuable information through their reflections. Therefore, this valuable information can be used by the department in assessing lecturers’ effectiveness as educators and revising the syllabus with the necessary inputs according to the students’ needs. This syllabus has always being revised over the years by the group of technical communication lecturers to cater to the needs of our engineering students and to keep abreast with the current needs of the faculty and students. The research will also reveal insights for engineering lecturers and those in other fields who want to embed eportfolio into their syllabus and curriculum. Thus, eportfolio could be used in other disciplines in order to achieve an optimum result in learning. Lorenzo and Ittleson (2005) suggested the use of eportfolios enabled the academic institutions to facilitate students by advising and collecting accreditation materials while enriching the students’ university experiences and preparing them for a career in engineering.

**Potential Benefits of Eportfolios for Stakeholders**

**Opportunities to obtain feedback and evidence.** Stakeholders can be the students’ parents, prospective employers, or a government body who will be able to use the eportfolio for many purposes with the students’ consent. They are able to discover the students learning development and gather evidence of the academic and social skills and career planning through collaboration among stakeholders (Bergman, 2000). Besides, they will also be able to view the good artifacts accomplished by the students. In terms of auditing and accreditation purposes, the professional body and enforcement agency can also use the eportfolios to examine the effectiveness of the academic
programmes offered by the university. Eportfolios have been reported to provide a more authentic analysis of an individual (Carliner, 2005; Heath, 2002; Robins, 2006). This is because they are more comprehensively representative of their achievements than examination results. Students can present their eportfolios with the tasks or assignments accomplished throughout their study, and also update them with current experience.

**Opportunities to facilitate relationship and improve syllabus.** Furthermore, the eportfolio system could benefit the institution through the collection of accreditation materials. This reflective aspect of the eportfolio system can facilitate the advising process between faculty and students when students provide valuable information through their reflections in the eportfolios. Therefore, the information can be used by the department in assessing lecturers’ effectiveness as educators and revise the syllabus according to the students’ needs. Thus, the eportfolio could serve as a web-based digital repository of artifacts to display and demonstrate the student's knowledge and performance (Greenberg, 2004).

**Eportfolios and Student-centred Learning**

A student-centred approach encourages students to participate in active learning, exploration and the construction of knowledge, rather than passively receive information (Jonassen, Howland, Moore, & Marra, 2003). Student-centred learning has been highly encouraged in the teaching and learning environment as a replacement for the traditional, teacher-centred instruction for many years. Student-centred learning requires students to set their own goals for learning, and determine resources and activities that will help them meet those goals (Jonassen, 2000). Cannon (2000) defines student-centred learning as ways of thinking that focus on student responsibility for planning, learning, interacting, researching, and assessing learning with the teachers and
students in the learning and teaching environment. Student-centred learning views students as active participants in creating their own knowledge (McInerney & McInerney, 2002). The lecturer’s role is known as that of ‘facilitator’ of learning rather than ‘transmitter’ of knowledge, and the student’s role is one of ‘independent learner’ rather than ‘passive recipient’ (Cole, 2000). Therefore, the lecturer will be facilitating the process of the development of the eportfolio activities and students will gradually take responsibility for their own learning (Glasgow, 1997).

The constructivist epistemology of learning has been greatly promoted in the need for more student-centred learning activities (Duffy & Jonassen, 1991; Jonassen, 1991; Wong, Jalil, Ayub, Bakar, & Tang, 2003). It is important to include the elements of being able to identify a problem, and to provide students with resources to solve the problem, when designing an instructional activity (Bednar, Cunningham, Duffy, & Perry, 1992). Therefore, student-centred tasks are challenging, real-life tasks, with technology as a tool for learning, communication, and cooperation. This approach was believed to enable students to have greater responsibility for, and ownership over, the learning process, that can lead to more effective learning (Jonassen & Land, 2000; Peters, 2000). In this research, the students are able to choose their own materials to include in their eportfolios as long as the minimum content requirements are met. This is done to ensure that the students have a sense of ownership over their eportfolios and complete control over who has access to the artifacts in them. As Charlesworth and Home (2004, p. 3) state,

When eportfolio advocates talk of learners ‘owning their eportfolio’, they rarely, if ever, mean to base that ‘ownership’ on the legal practicalities - it is rather a rhetorical tool (mis)used to emphasise the centrality of the learner’s own experiences to the eportfolio process - the learner more accurately has some control over the use of or access to, or has legally exercisable rights over or in, the data in the system.

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Some scholars have argued that the exceptional characteristics of educational technologies have the potential to change the role of lecturers and students (Acosta & Lui, 2006; Hanaffin & Land, 1997; Kapitzke, 2000; Spiro & Jehng, 1990; Tam, 2000; Vrasidas, 2000). Sheard and Lynch (2003, p. 2) state:

> Web-based environments can facilitate a shift in focus from teacher-centred to learner-centred education, encouraging educators to provide courses which enable students to manage their own learning. Enabling the learners more control of their learning has become the central goal or a desirable side benefit of computer technology.

Authors in support of new technologies have recommended that education technologies can allow students to learn at their own pace and at their own time (Cunningham, Tapsall, Ryan, Stedman, Bagdon, & Flew, 1998). As a result, the quality of the education will be more efficient, effective and affordable (Harley, 2001). Thus, students who use eportfolios will be more responsible in their learning, understand their strengths and limitations and learn to set goals (Christy & Lima, 1998; Heinricher, Miller, Lance, Kildahl, Bluemel, & Crawford, 2002; Hillyer & Lye, 1996). Educators believe that eportfolios allow students to think critically, and become active, and reflect on their studies and development (Ferguson, 2001; Pelliccione, Dixon, & Giddings, 2005; Perry, 1998; Rogers & Williams, 1998; Shepherd & Hannafin, 2011; Toohey, 2002). As Jonassen et al. (2003, p. 39) state,

> The internet is a tool with the potential to transform traditional teacher-directed instruction into powerful, student-led, inquiry-based learning. The internet expands opportunities for learning with a wide variety of resources and people providing multiple perspectives, access to diverse cultures, access to experts and access to information.

According to Dewey (1938), it is important to include activities in university learning which enable students to have opportunities to test theories and explore issues more critically. This is supported by Vygotsky (1978) who believed that learning was a social process in which learners enhanced their understanding through interaction with the environment around them. The author stated that learners are keener on exploring
concepts which are of interest to them, and discuss and negotiate the meaning of those concepts with other learners in an effective learning environment.

The role of teachers and students can be replaced with the ‘new media’ and ‘innovative delivery mechanisms’ (Halim, 1997, p. 145). Halim was commenting on Malaysian university education where he criticised the prescriptive teacher-centred approach and believed that educational technologies have the potential to deliver the promising student-centred approach to learning. Other studies have shown that constructivist approaches enhance students’ attitudes towards technology and allow students to be active participants in their own learning process (Wong et al., 2003). Thus, the incorporation of the eportfolio into the syllabus promises to create a challenging yet motivating learning environment for students.

**Using Eportfolios as a Learning Tool**

Researchers have claimed that eportfolios have the potential to document a student’s progress over time (Brown, 2002; Young, 2002). According to Foote and Vernette (2001), students can use their eportfolios to document the evidence of their tasks. As Jafari and Kaufman (2006, p. 7) noted,

> Those involved in learning and training are looking for tools to transform the learning experience, to enable learners to become autonomous and enjoy a truly personalized development path. It is our view that the e-Portfolio is one of the most significant tools for achieving this goal at all levels. It will support the realization of ‘portfolio career’ and act as an instrument for social inclusion, allowing all to ‘tell their story’ and celebrate their achievements.

Electronically facilitated and enhanced interactions might encourage students to articulate to others the meanings they have developed around their learning experiences, therefore gaining a better understanding of ‘what’ and ‘how’ they have learned (Davidson & Goldberg, 2009; Gee, 2009; Jenkins, 2008; Kahne, Middaugh, & Evans, 2009). Researchers such as Paulson, Paulson, and Meyer (1991) and Ring and Foti
(2003) have added that when students are provided an active voice in presenting evidence about the ‘what’ and ‘how’ of their accomplishment, they assume personal ownership for improvement. Students could review their artifacts and modify the learning goals as a result of the reflection. The eportfolios can also serve as a tool for lifelong learning and professional development through the process of reflection rather than through a collection of tasks. The students must be able to create the connection of the artifacts and the learning goal in the eportfolio. Barrett (2004, p. 3) stated that “the artifacts need to be accompanied by the learner’s rationale or their argument as to why these artifacts constitute evidence of achieving specific goals, outcomes, or standards”.

Research on student engagement with learning suggests that when students perceive that they have choices in how to learn subject matter, they are more motivated to move beyond mere information acquisition in order to gain a deeper understanding of the subject (Entwistle, 1998; LaSere Erickson & Weltner-Strommer, 1991; Ramsden, 2003). Students who use eportfolios will be more responsible for their learning, understand their strengths and limitations and learn to set goals (Hillyer & Lye, 1996). Educators have agreed that eportfolios allow students to think critically, and become active, independent and self-regulated learners (Hager et al., 2002; Mills-Counts & Amiran, 1991; Perry, 1998).

Wade and Yarbrough (1996) further reported on the pedagogical value of using eportfolios as a learning tool. Eportfolios are developmental in their nature because they document students’ growth and learning. Therefore, they should be utilized in short-term goal attainment and long-term learning outcomes. The eportfolio enables students to reflect on and document their learning process. Students can also use their eportfolios to share their work with their lecturer and peers in order to obtain feedback. Eportfolio allows cross-referencing of student work through hyperlinks. An example
would be if a science project also contained samples of mathematics problems. By using eportfolios, it is possible to create links between all the different kinds of work that is to be presented. In addition, the process of constructing and publishing the eportfolio can be viewed as a type of collaboration.

How can Eportfolio be used as a Learning Tool in a Technical Communication Course?

The current technical communication syllabus does not explicitly encourage engineering students to apply their knowledge and the skills learnt such as CAD and other devices in their engineering courses. CAD is the use of computer technology for the designing, drafting, and displaying of graphically oriented information. It allows students to create, visualize, and document their ideas clearly and efficiently in a visual (drawing) and symbol-based method of communication whose conventions are particular to a specific technical field. Therefore, the eportfolio allows the students to utilise the skills and knowledge in CAD and multimedia in demonstrating the real simulation in an interesting way. As engineers, the researcher believes that the students need to be equipped with the eportfolio as a tool to help them to be more creative and design authentic tasks and present them vividly to the intended audience who could be their lecturers, peers, employers and public.

The students are unable to express their ideas clearly and well on paper if they have a three-dimensional model, apart from their poor communication and presentation skills: therefore their excellent ideas could not be understood and this hinders their motivation to undertake the course. Engineering students at university should be explicitly taught reflection so that they can reflect and think critically on their assignments and improve themselves professionally. This is because these students need to be creative in order to
invent or create new ideas in the future, and also because engineers who display their eportfolio of work enable the reader to form a direct impression of their work immediately (Abrami & Barrett, 2005).

Some universities in Malaysia have used various approaches such as problem-based learning (PBL) (Adnan et al., 2009), project oriented problem-based approach (POPBL) and project-based approach (Idrus et al., 2010) to achieve their graduate attributes. One approach that has the potential to be useful in enhancing graduate attributes is the eportfolio. According to Wade and Yarbrough (1996), portfolios have pedagogical value as a learning tool. An eportfolio represents the students’ growth and learning as they store their artifacts which contain their assignments and reflections. Love and Cooper (2004) and three undergraduate engineering accrediting bodies in Australia (Engineers Australia, 2005), USA (Christy & Lima, 1998; Rogers & Williams, 1998) and the UK (EPC Assessment Working Group, 2002) have identified eportfolios as one of the possible approaches to help student attainment of graduate attributes. A substantial body of literature suggests following advantages of eportfolios: increase in the technological knowledge and skills; facility in distribution; storage of many professional documents; increase in accessibility; achievement of authentic learning; collection of evidence of graduate attributes (Barrett, 2005; Love & Cooper, 2004; Rogers & Williams, 1998; Tosh et al., 2005). Based on this literature, it appears that the eportfolio has the potential to enhance these graduate attributes. The researcher will explore this tool by embedding it into an existing technical communication course among engineering students.
Types of Eportfolios

Lorenzo and Ittleson (2005, p. 1) stated that eportfolios support career preparation and credential documentation; teaching eportfolios to maintain the sharing of teaching philosophies and practices of departmental and programme self-studies; and institutional eportfolios to record institutional and programme accreditation processes. There are several types of eportfolios that have received attention in the literature (Barrett, 2005; Ketcheson, 2001; Linn & Gronlund, 2000; Love, McKean, & Gathercoal, 2004; Simmons, 1996; Stefani et al., 2007; Wolf & Dietz, 1998; Yancey, 2001). These are listed below:

Course Eportfolios / Student Learning Eportfolios

Eportfolios completed by students for one course. The students store the work and reflect on the ways in which they have met the outcomes for that course. These eportfolios are regularly used for part of or the whole of the course for facilitating assessment and change;

Programme / Institutional Eportfolios

Students build up the eportfolios to store the assignments, the skills they learned and the outcomes they have met in the academic department or programme. It could be a requirement for graduation or student might use a selection from the eportfolios to show to their prospective bosses;

A Personal Development Planning Tool

Employees record their achievements, future plans, and extra-curricular activities. The mentor or appraiser could include comments in the eportfolio.
In this study, the researcher will introduce the course or student learning eportfolios, where the students will compile all their assignments and artifacts for the one semester into an eportfolio.

**Uses of Eportfolios**

In general, students are required to develop eportfolios related to learning and professional development, employment and assessment (Barrett, 2001; Hartnell-Young & Morris, 1999; Lynch & Purnawarman, 2004; Simmons, 1996; Strudler & Wetzel, 2005; Wolf & Dietz, 1998).

**Learning and Professional Development**

Students use eportfolios to show their capabilities and enhance their competencies (Milman & Kilbane, 2005). It is considered to be a personal learning management tool which encourages individual improvement, personal growth and development and commitment to lifelong learning (Abrami & Barrett, 2005; Arter & Spandel, 1992; MacIsaac & Jackson, 1994). The main participants in the eportfolio development process are learners, instructors, and institutions. The end-users of eportfolios are prospective employers, instructors (for assessment), parents, and award granting agencies (Stefani et al., 2007);

**Employment and Job Seeking**

Students use eportfolios to provide evidence of their abilities in job interviews in attractive ways (Milman & Kilbane, 2005);
Assessment of Student Learning and Professional Development

Eportfolios are used for assessment by university or organizations (Lorenzo & Ittleson, 2005) and to show accomplishment against criteria and rubrics for grading purposes.

Eportfolios in Different Disciplines: Teacher Education and Engineering

Review of Eportfolio Use in Teacher Education Programmes

Eportfolios have been included in teacher education degree programmes to document professional accreditation (Adamy & Milman, 2009; Gerbic & Maher, 2008; Lynch & Purnawarman, 2004; Strudler & Wetzel, 2005; Zeicher & Wray, 2001), and to access student performance (Barton & Collins, 1993; Fisher, 1994). Similarly, many authors have stated that the most major developments in eportfolio growth were in teacher education programmes in colleges (Barrett, 2000; Carmean & Christie, 2006; Gatlin & Jacob, 2002; Heath, 2002) where it was mostly integrated into pre-service teacher degree programmes (Adamy & Milman, 2009; Barrett, 2001; Penny & Kinslow, 2006; Shepherd & Hannafin, 2011; Wilhelm, Puckett, Beisser, Wishart, Merideth, & Sivakumaran, 2006). Carmean and Christie (2006, p. 7) state,

> Although shifting, the strongest movement in eportfolio implementation within higher education has been within the colleges for teacher education, where emphasis is being placed on the need for students to express their understanding at a higher level within Bloom’s taxonomy and to create outcomes that demonstrate the creation, integration and critique (Bloom’s synthesis and evaluation) of what they have learned.

Zeichner and Wray (2001, p. 614) note that eportfolios support students “to think more deeply about their teaching and about subject matter contents, to become more conscious of the theories and assumptions that guide their practices, and to develop a great desire to engage in collaborative dialogues about teaching”. Bartell, Kaye, and Morin (1998) investigated the use of portfolios in teacher education in the State of California and discovered that portfolios were very useful for teacher trainees in
displaying their artifacts and evidence showing their talent and capability. Similarly, Anderson and Demeulle (1998) carried out a survey on 127 teacher instructors in the United States on the use of eportfolios for the preparation of new teachers and found high levels of satisfaction on the usefulness of student eportfolios. Saipet (2005) conducted a study on the use of eportfolios by teachers and reported that workshop training should be prepared for teachers by professionals, documentation should be available, teachers should engage in continuous development, and they need to collaborate to enhance students’ skills. Several studies found eportfolios in teacher education to be ‘powerful tools’ as they facilitate reflective thinking when exposed to proper guidelines under the direction of and encouragement from the institution (Darling, 2001; Lyons, 1998; McKinney, 1998; Milman, 2005).

**Review of Eportfolio Use in Engineering Programmes**

The use of eportfolios in engineering programmes was examined to document achievement in the E3 Programme at Illinois Institute of Technology in the 1970s. Since the mid 1990s there has been evidence of the use of portfolios in engineering programmes at a number of institutions including Florida A&M, Iowa State, Lafayette College, Lehigh University, North Carolina A&T, New Jersey Institute of Technology, North Dakota State, Ohio State University, Polytechnic Institute, University of Colorado-Boulder, University of Oklahoma, University of South Carolina, Virginia Tech, and West Virginia University. Eportfolios have been used to support assessment of student achievement of learning outcomes in communication and design at the course level and across a programme, and the use of eportfolios has been concentrated in small programmes. The development of the eportfolio’s use in engineering programmes has been substantial at Rose Hulman, the University of Washington, and Oral Roberts University. Recently the South Dakota School of Mines has added an eportfolio
component to their freshman programme (370 students) and University of Texas Austin has developed an eportfolio system presently in use by more than 600 engineering students (Knott, Lohani, Griffin, Loganathan, Adel, Paretti, Wolfe, Mallikajunan, & Wildman, 2005).

**How Eportfolio is Used to Support Learning**

Many scholars have claimed that eportfolio has been used to support learning and assessment (Beck, Livne, & Bear, 2005; Hartnell-Young & Morris, 1999; Lynch & Purnawarman, 2004; Strudler & Wetzel, 2005; Wilhelm et al., 2006). These two criteria seem to have different perspectives and outcomes. When one looks at learning, it focuses on the ongoing development of the students. This is known as the process of learning and formative assessment will be applied here. The latter emphasizes the end product, where grades and marks will be awarded to the students, therefore, matching summative assessment.

**Is Eportfolio Used as an Assessment for Learning or of Learning?**

Eportfolio is a useful reference for students for reflection on formative or summative assessment, particularly teachers who can evaluate the eportfolio content based on the criteria and benchmarks selected (Barrett & Carney, 2005; Jafari & Kauffman, 2006; Moon, 1999; Stefani et al., 2007; Zubizaretta, 2004). There are two purposes of implementing an eportfolio: assessment for learning or formative portfolio and assessment of learning or summative portfolio.

Formative portfolio is defined as the process of seeking and interpreting artifacts to determine and improve the learners’ direction in their learning (Barrett, 2006; Julius, 2000). Students choose the artifacts to be included in their eportfolios throughout a
semester. The artifacts in the eportfolio are reviewed with the students and used to provide feedback to improve learning. The main reader and owner of a formative eportfolio is the student, where the student reflects on his or her growth over time and the lecturer acts as a facilitator in the classroom.

On the other hand, an eportfolio can be an assessment of learning, known as a summative portfolio, where students are asked to submit artifacts required by the university at the end of the semester to determine the outcomes of instruction. The content is largely determined by the institution and the students have fewer options and less ownership over the contents of the eportfolio. These eportfolios are validated on a rubric and quantitative data is collected for external audiences. This form of eportfolio is prepared for a set of outcomes, goals or specifications, and decision-making. Summative assessment has been reported to have decreased student motivation to learn (Assessment Reform Group, 2002). According to James, McInnis, and Devlin (2002), it is evident that students engage in a strategic approach to study and to the learning activities when their tasks are associated with grades. This finding is supported by Toohey (2002), who states that attaching assessment credit (marks) to the end product of eportfolio tasks is a helpful motivator for student engagement.

According to McMullan, Endacott, Gray, Jasper, Miller, Scholes, and Webb (2003), a conflict exists between the use of eportfolios as both an assessment tool and as a developmental learning tool. This is due to their dual use; assessment might have an unfavourable impact on the developmental learning value of the eportfolio with the result that eportfolio use might be used as an assessment. The literature reviews stated that the conflict concerns the reflective writing which is a major developmental component of eportfolios, where the ‘honesty’ of reflective writing could be influenced
by assessment, regardless of whether the assessment is summative or formative (Gannon, Draper, Watson, Proctor, & Norman, 2001). The conflict is about the reflective writing when the ‘honesty’ of reflective writing could be influenced by summative assessment. This assessment is likely to lead to alteration of the information as the students become reluctant to include factual stories and personal incidents such as problems and difficulties. Nevertheless, these real incidents are often triggering the real learning (Harris, Dolan, & Fairbairn, 2001). Although it has been emphasised how important it is to include reflection (Niguidula, 2005), students have been known to refuse having their reflections assessed (Tosh et al., 2005).

Similarly, the ability of students to reflect might confuse them about the use and effectiveness of an eportfolio as both an assessment tool and a developmental learning tool (Snadden & Thomas, 1998). Therefore, the researcher will employ formative assessment on the reflection artifacts to fulfil the objective of the research, which is to gather the ‘real voice’ of students in terms of their learning process. It is also believed that learning is a result of the physiological development of the individual (according to developmental theory), and therefore the main concern will be the process of constructing the eportfolio rather than the end product of the eportfolio (Smith & Tillema, 2003). Stiggins (1994, p. 87) suggested that an eportfolio is “a means of communicating about student growth and development” and “not a form of assessment”. Thus, the formative assessment will be used in this research.

**Eportfolio Adoption and Implementation**

Much of the literature about eportfolios focuses on their use in higher education. Discussions on eportfolios mostly centre on their implementation and integration within the curriculum. The issues were related to procedures for the development and
assessment of eportfolios, institutional policies, typical infrastructure requirements, their benefits, barriers and the strategies needed for the successful integration of eportfolios into higher education curricula for online and offline courses (Acosta & Liu, 2006; Carmean & Christie, 2006; Riedinger, 2006; Sherman, 2006; Tosh & Werdmuller, 2004; Tosh, Werdmuller, Chen, Light, & Haywood, 2006).

One of the early adopters of eportfolio approaches was Penn State University. The university employs the eportfolio developed from the use of personal web pages and its site is full of resources. The university defined eportfolios are “personalized, web-based collections that include reflective annotations and commentary related to these experiences” (Pennsylvania State University, 2007).

Research has been carried out in Marietta College in the United States where the eportfolio with reflective assessment promotes continuous improvement for both students and lecturers, and clarifies the relationship between course learning and lifelong career development (Cress & McCullough, 1995). This has supported the notion that eportfolios could foster active learning and lead students to engage in lifelong learning. Southard and Reaves (1995) conducted research by listing the desirable skills areas that their survey respondents considered necessary in technical communication professionals, which comprised writing, interpersonal communication, computer technologies, editing, organization, presentation, and critical thinking. These are the skills that a student can demonstrate all at once in the eportfolio. The input from communication professionals helps the eportfolios to be geared toward the professionals, in a more ‘reader-oriented’ way, closing the existing gap. Thus, the eportfolio could enhance graduate attributes among students when they engage in the learning process of the course.
A study conducted by Brown (2002) with adult learners who were developing eportfolios to document prior learning found that eportfolios increased students’ understanding of what, why, and how they learned throughout their careers, and improved their communication and organization skills. The results of this study strengthen the importance of reflection in learning. Similarly, Gee (2009, p. 14) believes that electronic media has the potential to support new ways of learning but more research needs to be done to ensure that the potential of electronic media in learning will be realised:

The emerging area of digital media and learning is not just the study of how digital tools can enhance learning. It is, rather, the study of how digital tools and new forms of convergent media, production and participation, as well as powerful forms of social organization and complexity in popular culture, can teach us how to enhance learning in and out of school and how to transform society and the global world as well.

Many studies on eportfolios use methodologies that incorporate data collection tools such as surveys and polls to obtain feedback from participants who rate the usefulness or value of eportfolios. Interviews were also used to elicit responses from the individuals or groups about implementation issues or the value of the eportfolios for instruction and assessment in higher education.

**How Eportfolio can Support Graduate Attributes**

From the researcher’s teaching experiences and from concerns voiced by the deans students lack communication skills, and the technological knowledge and reflection to plan, select, review and present their ideas in their assignments. Based on the literature, it appears that the eportfolio has the potential to enhance these graduate attributes. Therefore, the researcher will explore this tool as a means of enhancing these graduate attributes by incorporating the use of eportfolios into an existing technical communication course where students construct their eportfolio by using the free open source Google’s Blogger.
How Eportfolios are Used to Support Interpersonal Communication

According to Campbell and Schmidt (2005), eportfolios and other forms of assessment of student achievement are becoming important issues in engineering education. Good communication is defined by some engineering departments in terms of criteria such as writing manuals and evaluating the number of grammatical errors in a document. Therefore, the assessment of effective communication should involve discovering what constitutes communication, besides having good grammar and correct spelling and the capacity to evaluate engineering communication. Students are able to include visuals such as diagrams, charts, pictures and graphs. For example, charts are used to illustrate design procedures and to help students organize their thinking.

To evaluate communication skills, the researcher focused on students’ interpersonal skills when constructing their eportfolios. The students were asked to produce three written reflective entries and the researcher evaluated these entries by using writing rubrics to determine whether any significant difference had occurred in their written communication skills. The researcher also carried out an observation and analysed the communication among the students and the lecturer, based on observation notes. The criteria that the researcher examined included how students communicate with peers or their lecturer if they face any problems, how ideas are exchanged and how, in the classroom learning environment, students engage in learning when they complete the tasks given. The researcher also conducted focus group interview with students and an interview with the lecturer to discover how students interact, exchange, and share information when they create, develop, and use their eportfolios in their learning. There were two sets of questions preferred and actual questions of the Learning Process Questionnaire were distributed to students to examine how students interact with their
peers and complete their work in the classroom. A triangulation method was carried out to ensure the collected data was representative.

**How the Eportfolio is Used to Support Reflection**

The literature on education technologies emphasised the potential of technology-mediated education to facilitate critical thinking. Ellis (2001) stated that education technologies could include the deeper learning and critical thinking when used as an add-on to existing educational process. Other writers have suggested that students can revisit the same artifacts many times, with each visit having the potential to bring out additional aspects of the content because educational technologies display information in a variety of forms and formats (Spiro & Jehng, 1990). Thus, the eportfolio could be a potential tool to enhance students’ critical thinking and problem solving skills. The following are some examples of skills that fulfil the eportfolio and some of these skills are similar to the graduate attributes emphasized in the curriculum of higher education in Malaysia (Ministry of Higher Education, Malaysia, 2006).

- The ability to think about systems (both natural and social sciences).
- The ability to think in time - to forecast, to think ahead, and to plan.
- The ability to think critically about values’ issues.
- The ability to separate number, quantity, quality and values.

Reflection is a major component of eportfolios as it assists students to learn from experience and practice, thereby helping them to bridge the theory-practice gap (Gallagher, 2001). Eportfolio can be used to support learning and reflection on the process of learning (Carmean & Christie, 2006; Fernsten & Fernsten, 2005), and real life experiences. Students can apply reflective thinking to relate their experiences through the process of constructing an eportfolio (Barrett, 2001). According to Jonassen
(1996), the construction of an eportfolio shows the central features such as the complex thinking and creativity of the students. The students create and maintain their electronic repository of different files and use them to demonstrate competence and reflection on their learning in different domains. Students can better understand of their individual growth, learning, and career planning when they have access to their records, electronic repository, feedback, and reflection.

Reflection tends to remain private and actual reflection on action seldom becomes explicit unless specific processes are put in place to encourage this to occur. It is by making these thoughts explicit that a greater depth of understanding takes place (Sinclair & Woodward, 1997), hence the non-explicit ‘description only’ entries in journals, as the students struggled to find the purpose of such items. They were content to fulfil the basic requirements of the assignment as no guidelines or purposeful instructions were given to assist in the process. While they did not wish to become either prescriptive or restrictive, the faculty staff decided that a framework was necessary if these students were to develop reflective processes and eventually become truly reflective practitioners (Woodward & Sinclair, 1998). College and university educators have also seen the benefits to students that are the hallmarks of eportfolio practice: the opportunity for reflecting on their own writing process; the picture of their progress in writing over time; and the eportfolio as a showcase of their best work (Williams, 2001).

Eportfolios can also assist students to become critical thinkers when a two-way process between students and instructor reflections on learning and feedback is included in the course (Lorenzo & Ittleson, 2005). In addition, reflecting on learning can enhance critical thinking skills (Cook & Dupras, 2004). Zubizarreta (2004, p. 15) noted that
eportfolios “improve student learning by providing a structure for students to reflect systematically over time on the learning process and to develop the aptitudes, skills and habits that come from critical reflection”. Critical reflective thinking allows students to create meanings or concepts from learning experiences that enable them to see things from a different perspective (Kolb, 1984; McGill & Brockbank, 2004). Activities are related to specific learning experiences in which learners think about what they are learning, how new things being learned relate to their pre-existing knowledge, and how they are personally learning the new skills, knowledge, and/or attitudes (Sherman, 2006). Thus, eportfolios support reflection that can help students comprehend their own learning and take charge of their own learning process. Eportfolios help students to identify and reflect on the outcomes of learning experiences, to produce archives and presentations, made particularly appealing through the use of multimedia. An eportfolio embodies both the process of reflecting on learning experiences and the product of verifying claimed learning outcomes (Chun, 2002). The eportfolio tool is a semi-structured framework for reflective learning in that it goes well beyond filling in the blanks in a database like the conventional resume form (Barker, 2006). The process of reflection will make the eportfolio a tool for life-long learning and professional development rather than a mere collection of work (Foote & Vermette, 2001).

Researchers stated that eportfolios have the potential to document a student’s progress over time (Brown, 2002; Young, 2002). Reflective learning will be most effective when the contents are personal and ‘owned’ by the student (McMullan, 2008). Thus the use eportfolio in this study supports reflection as it can help students to comprehend their own learning and take charge of their learning process. Thus, the eportfolio provides a richer picture of student work to document growth over time. Stiggins (1994, p. 87) added that an eportfolio is “a means of communicating about student growth and development”.
Therefore, in this research, the students were allowed to take charge of their learning by selecting, reflecting, and displaying their artifacts. According to Moon (1999), reflection improves learning and practice. Reflections are pieces of artifacts that students need to demonstrate and review the process and products of their portfolio components. These artifacts are the most important components of the eportfolio and an important tool in the learning process. Students need to learn to self-analyse their own performance, know their strengths and weaknesses, contemplate strategies to enhance their success in future work and take responsibility for their learning. The lecturer needs to act as a facilitator to create and foster an effective reflection environment for reflection (Adams, Swicegood, & Lynch, 2004). It was intended that the eportfolio will be reviewed and shared and students will receive feedback from their lecturers. Questions that facilitate reflection include: Why do I choose this artifact? What are my strengths and weaknesses? Which parts of the eportfolio need to be improved? What do I like most and least about my work?

According to Moon (1999), critical thinking and written reflection are the most important parts of eportfolios for students. This is because written reflections provide room for generating practice-based theories, evaluating their practice, promoting self-awareness and revealing tacit knowledge of individuals. The process of constructing an eportfolio is the key component of learning as it allows the students to become active learners as they set goals for learning, engage in self-reflections, review goals periodically and take charge for their own learning (Venezky & Oney, 2004). There are several instruments used to investigate whether the use of the eportfolio could enhance students’ critical thinking and problem solving skills. These are the Learning Process Questionnaire: preferred and actual questionnaires, focus group interviews with
students and an interview with lecturer, document analysis of their eportfolios entries (reflection entries), and observation by the researcher. The criteria that the researcher evaluates are how students reflect on planning, selecting, reviewing and presenting the artifacts in the eportfolios’ entries and how the eportfolio could support and enhance their reflection.

**How the Eportfolio is Used to Support Collaboration**

Eportfolios enable students to engage in collaborative learning (Mason, Pegler, & Weller, 2004) as they share their artifacts and obtain guidance and suggestions from their instructor and peers (Wade & Yarbrough, 1996), and they also support student learning (Stefani et al., 2007). Collaborative learning is encouraged as students learn from the peers through mutual negotiation and communication until they reach a shared knowledge base without interference from the instructor (Lee & Wu, 2006). Studies have revealed that collaborative learning results in better learning outcomes than individual learning (Ferdig & Tramell, 2004; Halavais, 2005; Wu, Bieber, Hiltz, & Han, 2004) and eportfolios can be used as a collaborative learning tool. Eportfolios can facilitate students-to-students interaction and feedback from teachers (Brown, 2002). Campbell, Melenyzer, Nettles, and Wyman (2000, p. ix) stress the importance of eportfolios for collaborations,

> It takes encounters with peers, faculty facilitators and members of the larger professional community to challenge progress towards growing and changing, setting new goals...the more collaborative portfolio work becomes, the greater the growth in meeting the standards of higher-level learning.

This skill is also a part of the eportfolio as stated in the reorientation of basic education: the ability to work cooperatively with other people. If the future human capital can attain these skills, we can rest assured that the future generation will collaboratively share and cooperate as a taskforce towards the well-being of the nation. For teamwork skills, the researcher looks into the students’ collaborative activities such as when the
students write and post their cover letter, resume, and recommendation report and comment on their peers work based on their entries in their eportfolios. The feedback that the students obtained will enhance their peer learning through their collaboration among themselves. Students need to acquire these necessary attributes, which are important as engineers need to manage, organize, inspire and empower their subordinates and work together to achieve the goal of the company.

Document analysis of the eportfolios’ comments, focus group interviews with students and an interview with the lecturer and Learning Process Questionnaire: preferred and actual questionnaires were carried out to elicit information on how eportfolios could support teamwork. Observation by the researcher during tutorials also examined how students communicate in groups and pairs in getting their tasks done.

**How can Eportfolios Help to achieve these Graduate Attributes?**

In this study, the researcher used open source common tools such as blogs to create eportfolios, because students are familiar with blogs. Blogs allow the students to choose, design and create their artifacts in their own creative ways. These engineering students have the necessary web authoring skills that they have learned in the engineering course. In addition, they could practise their skills in the blogs.

**What is a Blog?**

Several authors have stated that a blog is a hypertext product that enables people to post or publish their thoughts and get feedback in the form of links and memos from people in a collaborative way (Blood, 2002; Flatley, 2005; Oravec, 2002; Williams & Jacob, 2004). Blogs allow students to engage in collaborative activity, knowledge sharing, reflection, and debate (Brooks, Nichols, & Priebe, 2004; Walker, 2005). Richardson
(2006) and Tosh and Werdmuller (2004) have identified the potential benefits of blogs used in connection with eportfolios. The advantages of blogs are the ease and immediacy of posting comments, and the process can be motivational (Flatley, 2005; Heafner, 2004). Blogs allow students full control and ownership over their online artifacts (Ferdig & Tramell, 2004; Goodwin-Jones, 2006). Blogs can record information about a student’s learning process: students can write their feelings and make them private or accessible by the public, which may encourage peer learning, interaction and support (Hall & Davison, 2007; Walker, 2005). Blogs fulfilled the cognitive learning theory proposed by Vygotsky (1978) and are a practical medium for students to reflect and post their ideas and feelings (Ferdig & Tramell, 2004; Flatley, 2005).

Why Blog?

The researcher utilized the open source common tools such as Google’s blogger platform because the students are familiar with blogs (Ducate & Lomicka, 2005; Huffaker, 2005; Quible, 2005). Students’ blogs are linked with students being more in control of their learning and being more active learners (Penrod, 2007; Richardson, 2006). There are several reasons for this, such as blogs allow the flexibility for students to have the freedom to choose, design and create their artifacts in their own creative ways as they have been equipped with the necessary web authoring skills from their engineering course and it is simple to manipulate as the user interface is easy to understand, create and edit, as well as, user-friendly and accessible. Templates were also available for those students who needed guidance in the initial stage. Furthermore, it is free and easy to set up, manage and update blogs frequently and without additional support; low cost as no software and licence are needed and blogs do not require expertise from the staff to maintain them. On the other hand, poor technical support and customer services provided by the purchase software vendor could hinder students’
process of learning and also result in lack of motivation, and the available software and
development may not keep pace with the needs of the students. The most important
reason for choosing a blog was because this free tool allows the students to own their
eportfolios even after they have graduated, as compared to expensive software available
in the market. Therefore, it could encourage lifelong learning as the students could edit,
create or add new information into their eportfolios.

The eportfolio’s purpose, audience, and the future use of the artifacts will determine
what artifacts are to be collected and developed as the content (Roy & Grice, 2003).
While the students can select the artifacts to be included in their individual eportfolios,
they nevertheless need to adhere to the requirement of the course by providing the
necessary artifacts for assessment purposes. The eportfolio works as an archive where
students are able to retrieve, keep track of and develop their content by adding or editing
the information in the eportfolio. A student’s eportfolio typically includes blogs, entries
of the artifacts such as a cover letter, resume, recommendation report, pictures, photos
and reflection entries. This eportfolio acts like a repository of content that students
generated throughout the course. The student owns the eportfolio and decides who can
view their artifacts and has access to the information. Eportfolios can increase students’
motivation because learners feel proud over the work they produce (Driscoll, 2000;
Genesee & Upshur, 1996; Tosh et al., 2005). Therefore, the sense of authority or
ownership takes charge of the learning process. In addition to that, a letter of consent
seeking permission from the students for allowing the researcher to view their artifacts
in the blogs was used in this study. The aim of a learning portfolio is to make its creator
a more effective learner who could produce better work in the future as he or she has
been exposed to the knowledge of reflection on the assignments and as a learner
(Hewett, 2004; Zellers & Mudrey, 2007).
How can the Eportfolio be Incorporated into a Technical Communication Course?

The study began on the first week of the semester and the lecturer selected (not the researcher) conducted the lecture and tutorials in the Technical Communication class for 14 weeks. One of the applications of the eportfolio is a course portfolio where eportfolios are assembled by students for one course. The students document and reflect upon the ways in which they have met the outcomes for that particular course. Course portfolios are often used for part or all of the course assessment (Stefani et al., 2007). Students are required to produce a cover letter, resume and recommendation report as part of the requirement of the course. Students were asked to reflect in a written form in their eportfolios in the 4th, 9th and 13th week of the semester. Students could apply reflective thinking to relate their experiences when creating artifacts such as the cover letter, resume and recommendation report, and when constructing their eportfolio. Students learn to apply reflective thinking to their experiences and generate meaning and discover their own learning through collaboration with, and feedback from, their lecturer (Lynch & Purnawarman, 2004). By using hypertext links, students could present and explore much documentary information in a way that reinforces the notion of learning as a shared, interactive process, inviting both the eportfolio student and target audience progressively deeper and more widely into the constructed process of learning. Eportfolio projects can display student work online and this is known as the ‘social action’ and ‘interactivity’ of learning (Yancey 2001, p. 20). Finally, the students were asked to submit their eportfolios in Week 14 and burn their work onto CD-ROM. Below is a rationale for how the evidence of graduate attributes was gathered in the course.

This study examines the use of eportfolio embedded into a technical communication course to develop learning in terms of students’ communication, critical thinking and problem solving, and teamwork skills among engineering undergraduates in Melaka,
Malaysia. In this study, the researcher revised the existing syllabus by incorporating the eportfolio process into the weekly plan. The syllabus comprises of a 14 weekly plan lectures and tutorials, with a one-hour lecture and two hours of tutorials. Student-centred learning is highly promoted here, where the students were free to collect their artifacts through the web for information, pictures, or video to be hyperlinked, for them to copy and paste or create their new document of knowledge and information. It has been found that student-centred learning activities support the development of higher-order skills such as critical thinking and problem solving. The instructor acts as a facilitator in the learning process supporting students in the process of constructing knowledge (Berge, 1999; Nelson, 1999) rather than being perceived as the sole authority. The students have the authority to adopt a more active role in their learning by organizing, analyzing, synthesizing, and evaluating artifacts presented by the lecturer to the students (Means, 1994).

For these eportfolios, students were required to complete some tasks that encourage them to reflect on their learning when writing their reflections. In addition, the role of the lecturer in explaining the benefits of reflection to students was also necessary. It was also important for the lecturer to provide regular support and feedback. The process of reflection helps the student to construct meaning from the work and the artifacts they have selected, and the eportfolio could be an additional aid to enhance the artifacts, particularly when using CAD to demonstrate the engineering concepts and mechanisms. The eportfolio was employed in the study, where students plan, collect, organize, reflect on, and present the artifacts completed in response to their interests, requirements, and understanding. The students were required to build and document their eportfolios, and reflect on their learning, the lecturer acting as a facilitator giving constant encouragement and feedback to the students. Therefore, students would understand
better what they have learned and would take charge of their own learning process within the university and throughout their lives.

Finally, the eportfolio can also allow cross-referencing of student work through hyperlinks. This can be done if the student wants to hyperlink the blogs. By using eportfolios, it is possible to create links between all the different kinds of work that is to be presented.

**A Conceptual Model of the Constructivist Learning Environment**

According to Sim (2005), when one discusses the marketability of university graduates one must consider the academic and competency relevance. Competency relevance is associated with the inherent learning aptitude and character development of an individual during the process of university education. Thus, eportfolios can be utilized in order to complement the above claim. The eportfolio is a concrete representation of critical thinking and reflection. Furthermore, it could be used to showcase students’ achievement and their growing capabilities in using technology to support their ongoing professional development. Students could burn their eportfolio onto CD-ROM so that it can be available in a form that students are able to view, and reused after they have graduated. The researcher also hopes that students would save their documents on blank Zip disks, to allow some flexibility in the way they transport their personal eportfolios to job interviews.

The researcher is going to utilize the open source common tools such as *Blogger* because the students are familiar with blogs, it allows the flexibility for them to have the freedom to design and create their artifacts in their own creative ways as they have been equipped with the necessary web authoring skills from their engineering course and it is
easy to manipulate as the user interface is friendly and accessible. Templates were also available for those students who needed guidance in the initial stage. It is low cost as no software and licence are needed, and it does not require expertise from the staff to maintain. Other reasons, such as poor technical support and customer service by the vendor could hinder the process of learning and also result in lack of motivation. Furthermore, the available software and development may not keep pace with the needs required by the students. The most important that factor was that this free tool allows the students to own their eportfolios even they have graduated as compared to the expensive software available in the market.

An eportfolio should be a story of learning that is owned by the learner, structured by the learner, and told in the learner's own voice. Students are able to identify gaps in knowledge skills and competence in the reflective process (Grant & Dornan, 2001) and also reconfirm and display evidence of strengths, skills and knowledge (Harris, Dolan, & Fairbairn, 2001). Zubizarreta (2004, p. 15) defined learning portfolios as ways “to improve student learning by providing a structure for students to reflect systematically over time on the learning process and to develop the aptitudes, skills, and habits that come from critical reflection”. The learning portfolios are a type of constructivist assessment, the standard is set by the one who constructs the eportfolio, and the material created does not lend itself to measurement (Paulson & Paulson, 1994, p. 7). The students select the artifacts in the eportfolio for their ability to display what they have learned. Therefore, the aim of a learning portfolio is to make its creator a better learner who could produce better work in the future, as the student has been exposed to the knowledge of self-assessed current work and of the self as a learner (Hewett, 2004; Zellers & Mudrey, 2007). A learning portfolio can be supported with a web log environment ('blogs’) and the process of the eportfolio involves activities referred to as
a ‘Plan–Do–Review’ cycle (Pallister, 2007), as shown in Figure 1.1, that follows the theories of Kolb’s Learning Cycle (Kolb, 1984) and the theories of Action Learning (McGill & Brockbank, 2004).

**What to Include in the Eportfolio**

The artifacts to be included in the eportfolio will depend on the purpose and context of its developing the eportfolio (Wolf, Whinery, & Hargerty, 1995). A simple student eportfolio should include:

- **Title**
  
  The title consists of the student’s names and the academic year. It may include a picture or video of the student.

- **Table of contents**
  
  This is a summary of the eportfolio. Links may be added to guide the viewer.

- **Samples of work**
  
  Included are artifacts (assignments) cover letter, resume, reflection entries, mock meeting, mock interview, and recommendation report.

- **Biodata**
  
  This acts as a window into the student’s life and makes the eportfolio more personal.

- **Students’ reflective notes**
  
  These are the students’ reflection of their work in this course.

- **Others**
  
  Any information that the students would like to include.
Review

The eportfolio is a result of technology being readily and conveniently used in most classrooms today. They are highly motivating for the students who are encouraged by exhibiting their work in Microsoft Word, Microsoft Power Point, Adobe Acrobat, and WWW pages created with HTML editors. These are the most common software packages used for eportfolio development (Barrett, 2000). Hartnell-Young and Morris, (1999) supported this by stating that creating eportfolios with hypertext links enables students to gain better comprehension and explanation when linking their documents, artifacts, and reflections.

In addition, in order to display artifacts efficiently links can allow the connection of materials in a personal archive to become broader and more thoughtful.
CHAPTER 4  METHODOLOGY

Introduction

The broad context for this study is that all Malaysian public and private universities must incorporate graduate attributes into their curriculum from August 2006. Assessing student achievement of the attributes is therefore important. Eportfolios have the potential to improve learning and to assess graduate attributes. This study will investigate whether eportfolio can enhance graduate attributes, particularly communication skills, critical thinking and problem solving skills, and teamwork skills. The key questions to be explored are: To what extent does the use of an eportfolio enhance students’ communication skills, critical thinking and problem solving skills, and teamwork skills?

This chapter will address the research methodology used in the study. The research methodology has been planned to answer the research questions and meet the objectives of the research. Thus, this study hopes to find evidence that the use of an eportfolio could enhance students’ graduate attributes, particularly communication skills (CS), teamwork skills (TS), and critical thinking and problem solving skills (CTPS). The eportfolio as a learning tool was embedded into a technical communication course. The research was carried out in a Malaysian university for engineering students with intermediate ESL proficiency. Some aspects related to the research design, population and sample, instruments, procedure, data collection, data analysis will be discussed in this chapter.

Research Design

Savenye and Robinson (1996) argued that the choice of research method (or methods) should be driven by the questions that the researcher seeks to answer. Mixed methods
research is beneficial to researchers as the research method is defined as: “the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study” (Johnson & Onwuegbuzie, 2004, p. 17). In addition, mixed methods allow data to be triangulated to provide a better picture of the data collected (Lincoln & Guba, 1984).

This study uses a mixed methods research approach which seeks evidence of the impact of an eportfolio in a technical communication course to enhance students’ learning in terms of communication, teamwork, and critical thinking and problem solving. This is because the researcher believed that a single quantitative or qualitative methodology would not be enough to address all the questions in this study. The purpose of the mixed methods research is not to replace quantitative or qualitative research but to use them to enhance the strengths and reduce the weaknesses of both methodologies, both in single research studies and across studies (Johnson & Onwuegbuzie, 2004; Onwuegbuzie & Leech, 2004). Thus, a mixed method was applied where a qualitative research approach, called a ‘case study’, formed the methodological framework of this investigation.

Meriam (1998, p. 19) stated that a case study should be,

Employed to gain an in-depth understanding of the situation and meaning from those involved. The interest is in process rather than outcomes, in context rather than a specific variable, in discovery rather than confirmation. Insights gleaned from case studies can directly influence policy, practice and future research.

The case study gives a complete and overall account of a phenomenon occurred in real life situations and proposes insight and illuminates meaning that expand the readers' experiences (Merriam, 1998). Yin (2009, p. 23) defined a case study as,

An empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident and in which “multiple sources of evidence” are used.
Yin (2009) elaborated that the important tools needed for data collection are interviews, participant-observation, archival records, physical artefacts, direct observation, and documentation. The case study in this research study incorporated a number of data gathering techniques, including *preferred* and *actual* questionnaires, focus group interviews with students and an interview with the lecturer, observation, and document analysis to analyse the learning outcomes, and experiences of the use of eportfolio in enhancing the communication, teamwork, and critical thinking and problem solving in the course. These are three of the graduate attributes of university graduates sought by the Malaysian government. The syllabus of the technical communication course was revised to cater to the needs of the research. This research involved a case study and an adaptation of a ‘Plan-Do-Review’ model (Pallister, 2007) to frame the study. A case study in qualitative research gives flexibility for the researcher’s involvement in the study and uses multiple data to gather techniques for triangulation (Merriam, 1998).

There were multiple sources of evidence to collect included students’ reflection entries in their eportfolios, focus group interviews with students, and an individual interview with the lecturer, questionnaires data, and observation in the classroom.

**Population and Sample**

There are approximately 240 students in the entire population who took the Technical Communication course. These students are from Faculty of Information and Communication Technology and Engineering. Only engineering students were sought to participate in the research. Initial consent and approval were sought from the deans of the engineering faculties to allocate 66 students to this research purpose. Permission was also sought and approval gained from the Human Resource Management Division to allow the researcher to conduct the research in the university and use the students as her participants. The 66 students were given a consent form to participate in this study,
and their participation was entirely voluntary. They could withdraw at any time and there were no penalties for non-participation. These students are from one of the universities in Malaysia.

**Participants**

The participants in the study comprised one class of 66 students from a potential pool of five classes with 240 students in total. The participants in the study comprised one class of 66 students from a potential pool of five classes with 240 students in total. The class used for this research had been given approval and consent from the deans. If the researcher did not get enough participants from these sampling, then she would need to seek participants from other classes which have been given approval and consent from the deans. There is no existing relationship between the researcher and participants.

These students were second year engineering students who took a technical communication course as a requirement of their programme. They are aged from 20 to 22 years old and comprised of 12 females and 54 males. Their ethnic origins are Malays, Chinese and other. These students have been using English as the medium of instruction for the engineering undergraduates in the university in Malaysia. Therefore, the students should have no difficulty in understanding and following simple instructions in English. These students have also been exposed to English language study for more than 12 years. Nevertheless, the lecturer was available to interpret the questions if there was a request from the students.

A total of 66 students were asked to consent to participate in this study. They were given an Information Letter for Students (Appendix C) and Consent Forms in the first meeting of the class in the semester. All students were given the consent forms to
complete two forms of the questionnaires: *preferred* and *actual* (Appendix D); to allow observation in the tutorial by the researcher (Appendix E); and to allow the researcher to access their artifacts in their eportfolios and submit three written reflections (Appendix F). The classroom observations were carried out during tutorials in the computer lab to discover how the lecturer assists students to work collaboratively and use their interpersonal communication skills to get their tasks done in the eportfolio. If the students do not want to be observed, then adjustment could be made by structuring and organising them to a different tutorial. As noted in the Information Letter, students were informed that their participation in this study is entirely voluntary. They may withdraw at any time and there will be no penalties for non-participation. All information is treated as confidential and no names or other details that might identify them would be used in any publication arising from the research. If they withdrew, all information that they provided would be destroyed.

All participants were asked to give consent to participate in one of the five focus group interviews (Appendix G). The 25 students were randomly selected from the whole class who gave their consent to participate in the focus group interviews. Each student was interviewed once in one of the five focus group interviews. The number of respondents was considered sufficient as the participants had given their consent in the first meeting of the week. This meant that other students from other classes needed to be sought to participate in this research study in order to get the desired number of participants. The students were aware that at any stage of the activities they could withdraw as a participant without any negative impact. As noted in the Information Letter for the Lecturer (Appendix H), one lecturer was asked to give consent (Appendix I) to participate in the research. The lecturer participated in an individual interview.
Conceptual Framework

This study examined the learning process in developing an eportfolio by adapting the Plan-Do-Review cycle (Pallister, 2007) as shown in Fig.1.1. This cycle incorporates both the approaches of Kolb’s Experiential Learning Cycle (Kolb, 1984) and Action Learning (McGill & Brockbank, 2004), as outlined in Pallister (2007). These two approaches are based on constructivist learning principles (Jonassen, 1994). This research examined the use of the eportfolio embedded into a technical communication course to develop learning in terms of students’ communication skills, critical thinking and problem solving skills, and teamwork skills, among engineering undergraduates in a university in Malaysia. In this study, the researcher revised the existing technical communication syllabus by incorporating the eportfolio learning process into the weekly plan. The syllabus comprised of a 14 week plan of lectures and tutorials with a one-hour lecture and two hours of tutorials per week. Lorenzo and Ittleson (2005, p. 1) stated that eportfolios are used as support credential documentation. Students were free to collect the artifacts through the web for information, pictures and video to be hyperlinked and included in their eportfolios as long as the minimum content requirements were met. This was done to ensure that the students had a sense of ownership over their eportfolios and took responsibility for their own learning. The eportfolio employed in the study, where students collect, organize, and reflect on the artifacts completed in response to the student’s interests, requirements, and understanding in one semester. The process of learning between all students should be collaborative and communicative at all phases of development. It was found that student-centred learning activities support the development of higher-order skills such as critical thinking and problem solving (Savery & Duffy, 1995). The constructivist epistemology of learning has been greatly promoted in response to the need for more student-centred learning activities (Duffy & Jonassen, 1991; Jonassen, 1991). The
students had the authority to engage in a more active role in their learning by transferring the responsibilities of organizing, analysing, synthesizing, and evaluating artifacts from the lecturer to the students (Means, 1994).

For these eportfolios, the students were required to do assignments and assessment that encouraged them to reflect on their learning when writing the reflection entries. These assignments were a cover letter, a resume, and a recommendation report, and assessments were a mock interview, a mock meeting and an oral presentation of a recommendation report. Schon’s ‘reflection on action’ is a process of rethinking of one’s prior thoughts and actions in context, where he states that “we reflect on action, thinking back on what we have done in order to discover how our knowing-in-action may have contributed to an unexpected outcome” (Schon, 1983, p. 26). The process of reflection helped students to construct meaning from the work they had selected and the eportfolio facilitates the process of making meaning of the artifacts. A learning eportfolio is where reflection and documentation (or the artifacts) combine with collaboration or conversations about learning. Therefore, students will understand better what they have learned and take charge of their own learning process within the university and throughout their lives.

The students were asked to create and develop their eportfolio and reflect on their learning. The lecturer facilitated the process of the development of the eportfolio activities and students would gradually take responsibility for their own learning (Glasgow, 1997). This was supported by Hillyer & Lye (1996) who found that when students use the eportfolios, they are more responsible for their learning, know their strengths and limitations and learn to set goals. Educators believe that eportfolios allow
students to think critically, and become active, independent and self-regulated learners (Mills-Courts & Amiran, 1991; Perry, 1998).

**Data Administration and Collection**

Data sources for the quantitative and qualitative analyses included questionnaires, interviews, document analysis, and observation in the classroom. These data provided important insights into students’ perceptions of their learning process and in investigating whether the use of the eportfolio will enhance students’ graduate attributes.

**Learning Process Questionnaire**

The objective of the questionnaires was to discover whether graduate attributes, particularly communication skills, teamwork skills, and critical thinking and problem solving skills were enhanced when students used the eportfolio as a learning tool in the technical communication course. Quantitative analysis of survey results is familiar in qualitative studies to validate results (Yin, 1994). Questions were constructed to find out the impact of the use of an eportfolio as a learning tool on the three graduate attributes. This was to measure to what extent the use of eportfolio benefited students, particularly in relation to the three graduate attributes and also to the learning tool.

The research instruments used for this survey were the two forms of the questionnaire: preferred and actual learning process questionnaires were administered to the 66 students to find out whether their perceptions of the use of eportfolio had any effects on their interpersonal communication, reflection, and collaboration. The questionnaires were adapted from the Constructivist Multimedia Learning Environment Survey (Maor & Fraser, 2005). The questionnaires were distributed to the same students before and
after their eportfolio experience. This provided an internally consistent set of data, together with a more complete understanding of how the views of students and the underlying factors changed over time. Surveys were administered in the second week of the semester (before students were introduced to eportfolios) and in the second-last week of the semester after students had completed all the assignments required for assessment. Each of the questionnaires took approximately 20 minutes to complete. The student was required to write the number previously assigned to him or her by the lab assistant, and to submit the completed survey to the lab assistant.

The *preferred* form (see Appendix J) allows students to give opinions about their ideal or desired learning in the classroom, while the *actual* form (see Appendix K) assesses students’ *actual* experience of the learning process and perceptions of the use of the eportfolio in the classroom. There were 30 close-ended questions with five items in each scale. Each scale was in the form of a five-point Likert scale as follows: Almost never (1), Seldom (2), Sometimes (3), Often (4), Always (5). Likert scales were used in order to determine the strength of the views held by the students about the use of eportfolios. The wording of the items for *preferred* and *actual* forms was similar but different patterns were used for each item; for example, if an item on the *preferred* form is, “I will get the chance to interact with other students” and the parallel *actual* form is, “I got the chance to interact with other students”.

There are three sections in the questionnaire: I. Background information; II. Interpersonal communication, reflection, and collaboration; and III. Students’ perceptions about the use of eportfolio in a Technical Communication Course.
Section I sought background information such as the student’s gender. This was to see whether there was any significant difference between male and female students in the learning process when using eportfolios in a technical communication course.

Section II investigated three graduate attributes; namely, interpersonal communication (communication skills), reflection (critical thinking and problem solving skills) and collaboration (teamwork skills), where students tick the stem that reflects their closest answer. There were five stems in each scale. In the interpersonal communication scale, questions were constructed to determine how students interact with their peers and get their work done in the classroom. In the reflection scale, questions were developed to find out how students reflect while constructing the eportfolio. The scale for this section was collaboration, where questions were constructed to elicit responses that could provide an understanding of how students work together in achieving their aims and improve their own learning. Students were also asked to write any additional comments they wished in the space provided after each scale.

Students were asked additional questions in the preferred questionnaire, including:
What do you hope to learn from using eportfolios in this Technical Communication course? The actual questionnaire included these two specific questions:
(i) What have you learnt from using eportfolios in this Technical Communication course?
(ii) Do you have any negative experience(s) from using eportfolios in this Technical Communication course? If yes, please explain.

According to Punch (1998), statistical methods were suitable for analysing the quantitative data as the research shows the relationships between variables that were
governed by the research questions. Questionnaire responses were analysed in terms of frequency and percentage. For this purpose, all the blank responses had to be handled. The pure data had to be coded or categorized and keyed in using the Statistical Package for the Social Sciences (SPSS) version 17.0 data editor, in order to calculate and make meaningful the data to answer the research questions. Following this, the descriptive statistics analysis were analysed to examine the central tendencies and dispersions. The maximum and minimum scores, mean, standard deviation, variance, and other statistics were obtained to indicate whether the responses range satisfactorily over the scale. The frequency distribution of the ordinal variables was also obtained with visual displays in the form of bar charts. Cronbach’s alpha test of reliability was performed on each set of data to identify the internal reliability of the survey. Next, the inferential statistics were analysed to examine the relationship between the independent variable and dependent variables, using paired t-test. Scale scores from the students’ preferred form and actual form of the Learning Process Questionnaire were tabulated and reported in the Findings chapter.

The comments filled in each of the scales were analysed by the researcher. The response in the additional open-ended questions was analysed and grouped according to the themes, to support the quantitative findings.

**Administration of Instrument**

The researcher asked the lab technician to provide a code for each of the students in order to remain anonymous to the researcher. The researcher administered the preferred form of the Learning Process Questionnaire to the students. In order to ensure confidentiality for the students, the lecturer left the lab, thus lab technician monitored its completion and securely enclosed it in a sealed envelope. The researcher explained the
purpose of the questionnaire, read the instructions, and answered any individual questions from the students. Assurance for complete anonymity of answers was given and it was explained that the code number was to be placed on the form so that the students’ preferred and actual answers could be compared. When all students had completed their questionnaire, the lecturer returned to the lab and carried on the usual teaching activities. The remaining time of the class period was spent by the researcher observing interactions between the lecturer and her class, and interactions between the students. Scale scores from the students’ preferred form and actual form of the Learning Process Questionnaire were tabulated and reported in the Findings chapter. At the end of the thirteen weeks, all students completed the students’ actual version of the Learning Process Questionnaire as a post test.

**Interview**

The purpose of interviewing is very useful as it allows some of the participants involved to discuss, defend and elaborate on findings based on questionnaire data, and it enables the researcher to understand the other’s perspective (Patton, 1997). In this research, there were two interviews: focus group interviews with students, and an interview with one lecturer.

**Focus Group Interviews with Students.** The purpose of using focus groups as an inquiry strategy in this research was to highlight this interactive aspect of data collection and generate themes based on the participants’ insights. According to Lunt and Livingstone (1996, p. 96), “focus groups generate discussion and so reveal both the meanings that people read into the discussion topic and how they negotiate these meanings”. Similarly, Morgan and Krueger (1998, p. 12) states that “the hallmark of focus groups is the explicit use of the group interaction to produce data and insights that
would be less accessible without the interaction found in a group”. Focus groups produced qualitative data that provide insights into the attitudes, perceptions, and opinions of participants. Riessman (1993, p. 4) notes that “a primary way individuals make sense of experience is by casting it in narrative form”. The data from the students’ interview was the verbal expression of their thoughts, opinions, and feelings of how they create, develop, and use their eportfolios in their learning. The researcher used open-ended questions but participants were given opportunities for any group discussion. The focus group has a more natural environment as compared to an individual interview because “participants are influencing and are influenced by others - just as they are in real life” (Krueger, 1994). Questions were constructed to examine the views and thoughts of the students regarding the functionality of the eportfolio as a tool in facilitating and generating reflection, interpersonal communication, and collaboration in the Technical Communication course (see Appendix L).

The researcher conducted focus group interviews with the 25 student volunteers to elicit more information on students’ perceptions of how they used the eportfolio in the course. The students comprised 11 females and 14 males, and the interviews were conducted in English and were carried out by the researcher in Weeks 13 and 14 of the semester. The students were randomly selected from the whole class, who had given their consent to participate in the focus group interviews. Each student was interviewed once in one of the five focus group interviews and the interview was facilitated by the researcher. Each student was also given a code to protect his or her identity. For example, Student 1 from Group 2 was coded as (2C1). Kvale (1996) states that private information that might identify the participants will not be reported as it is classified as confidential in research. He elaborates that there is a need to change the participants’ names and identifying features in order to protect their identity, which is an important issue in the
reporting of interviews. They will be aware that, at any stage of the activities, they can withdraw as a participant without any negative impact. The interview for each of the focus group student took approximately 20 minutes. The focus group interviews with the students were audiotaped and field notes were taken with the consent of the students.

The interviews were recorded so that the researcher would have the exact wording of what was said by all participants, thus eliminating the possibility of guessing what was said. All participants were given paper and pen to write down their responses. The interviewer wrote down the response given by the students during the interview session. The importance of standardized recording is to eliminate interviewer judgement and interference on the written response (Fowler & Mangione, 1990). The students’ interview were then transcribed and analysed. Riessman (1993, p. 60) states “close and repeated listening, coupled with methodic transcribing often leads to insights that in turn shape how we choose to represent an interview narrative in our text”. Punch (1998) added that the process of analysing gives meaning to the data by organizing the raw data into patterns, categories, and basic descriptive units. Students’ data was analysed anonymously using the code numbers assigned to them. All interview responses were transcribed and analysed and narrative descriptions used the responses to categorize them by identifying patterns and summarizing responses in order to bring meaning to the text.

**Individual Interview with Lecturer.** The researcher conducted an interview with one lecturer in Week 14. This was to confirm the experiences encountered by the lecturer during the course of the implementation of the eportfolio as a learning tool in the course (see Appendix L). Questions were developed to ascertain the views and
thoughts of the lecturer about the functionality of the eportfolio as a tool in facilitating and generating interpersonal communication, reflection, and collaboration in the Technical Communication course. The interview took approximately 20 minutes and was audio recorded and transcribed for analysis. All interview responses were transcribed and analysed and narrative descriptions used the responses to develop categories by identifying the patterns and summarizing them in order to bring meaning to the text.

**Document Analysis**

The document analyses were used to obtain reflections from the students. These reflections artifacts were collected as evidence to show whether the learning process has growth as the result of the eportfolio as a potential tool in enhancing critical and problem solving skills. This document comprised three written entries of reflection created by students. The students reflected on their learning in three intervals: on the 4\(^{th}\), 9\(^{th}\), and 13\(^{th}\) week. The lecturer and the researcher subscribed to Really Simple Syndication (RSS), a format used to publish frequently updated works such as blog entries, audio, and video in a standardized format. Therefore, they were able to receive updates of the entries from the students. Based on student consent, the researcher had accessed to students’ artifacts in their eportfolios via online and CD-ROM for documentation and analysis. Document analysis, comprising the students’ written reflections were analysed using the reflection rubrics (Appendix M) taken from Klein (2003). The researcher wanted like to find out whether any change occurred in their reflections in the process of constructing their eportfolios in a semester. These entries were also analysed using a written communication rubric (Appendix N) developed by the Teaching and Learning Centre at Murdoch University (2004) to track whether students’ written communication showed any significant difference over time. The data
from the eportfolio entries were analysed using content analysis to look for patterns and summarize them in order to bring meaning to the text.

**Observations**

The observations of the researcher during the tutorials were focused on the teamwork skills and communication skills as students engaged in the process of constructing their eportfolios. Ten observations were conducted by the researcher during the semester to examine how students manage their eportfolios, such as when they create, design, and display them during tutorial sessions. The criteria that the researcher looked into comprised how students communicate with their peers or lecturer if they have any problems, how ideas are exchanged, how the classroom learning environment engages students in learning, how the students complete the tasks given, and how students communicate in their group and also in pairs in getting their tasks done.

**Administration of instrument.** The researcher visited the class twice a week for ten weeks prior to distributing the Learning Process Questionnaire: actual form and interviews with the students. The researcher made visits to observe the students on aspects of their learning, especially their communication skills and teamwork skills during different types of activities.

**Procedure**

The study began in the first week of semester and the lecturer conducted the lecture and tutorials in the Technical Communication class for 14 weeks. The lecturer distributed the information letter and consent forms to students during the tutorial. The students read the letter and asked questions if they did not understand its content. The researcher briefly explained the implementation of the research and that students’ participation in
this study is entirely voluntary. They may withdraw at any time and there will be no penalties for non-participation. They were given four consent forms for questionnaires, classroom observation, document analysis of assignments, and student focus group interview. The students were required to sign the forms if they decided to participate in the research.

The researcher distributed the information letter and consent form to the lecturer, and explained to the lecturer the nature and process of carrying the research. The lecturer signed the consent form to take part in this research, following which the researcher could proceed with the research. The researcher then briefly explained the importance of graduate attributes and how they link to the eportfolio. The potential of the eportfolio as a tool to enhance graduate attributes, particularly communication skills, teamwork skills, and critical thinking and problem solving skills was also explained. Following this, the researcher asked the lab assistant to assign a number to each student and the students were introduced to the eportfolio concept and carried out some activities pertaining to it. The lecturer also explained the concept and how it relates to the course and employment. The model ‘Plan-Do-Review’ by Pallister (2007) was used to explain how eportfolio works and to demonstrate the graduate attributes. The lecturer showed samples of eportfolios online, from simple to advanced eportfolios, and also reflections completed by students from other universities. The procedure was then repeated in the next tutorial with different groups of students.

In Week 2, the researcher gave the preferred questionnaire (Learning Process Questionnaire) to students to be completed within 20 minutes. The researcher stayed in the classroom to clarify any questions from students. Student were asked to write the code number assigned by the lab assistant earlier on top of the questionnaire and to
submit the completed questionnaire to the lab technician, after which they were asked to create an individual account at http://www.blogger.com following the prompt by the Blogger. Students could seek help from their lecturer if they encountered any difficulty during that stage. The students then added five peers, the lecturer, and the researcher to view their eportfolios. The peers chosen would later work together on their recommendation report. The student owns the eportfolio and has the freedom to choose what to include in it and to control access to it.

The students were required to work alone to produce assignments such as cover letter and resume and also work in groups to produce recommendation report for assessment purposes. Therefore, they were given the freedom to add in any artifacts they thought might enhance their learning. They were also encouraged to view, and give constructive and quality feedback to, their peers’ eportfolios in the comments box of the eportfolio.

The researcher observed students’ interpersonal communication and collaboration with their peers and also with the lecturer during the tutorial. Also, observed was how students managed their eportfolios, such as when they create, design, and display in the tutorial session. Furthermore, the observation looked at the collaboration and interpersonal communication skills of the students when they engaged in the process of constructing their eportfolios.

In Week 3, students were asked to work on their first individual reflection. The lecturer facilitated the process of constructing the entry. Prompt questions for the students included:

(i) **What?** What is the experience of creating an eportfolio?

(ii) **What and how?** What is the artifact? How you select the artifacts to be included in the eportfolio?
(iii) **So what?** What does the artifact say about your growing competence? How do the artifacts represent you? Does the experience of constructing your eportfolio benefit your learning?

(iv) **Where and why?** How will the skills you’ve gained transfer to new experiences or create new discovery in your learning?

(v) **Now what?** Make notes on how you can use what you’ve learnt from this experience in your future.

*Source: Adapted from Campbell et al. (2007).*

Samples of reflections were also shown to students. The researcher observed the students’ interpersonal communication and collaboration among their peers and also with the lecturer in the tutorial, and viewed both the students’ entries in their eportfolios and the feedback given by them.

In Week 4, students were asked to submit their first reflection in the eportfolio after they could view and give feedback on their peers’ eportfolios. Observation was carried out by the researcher during the tutorial to see how students interact and work collaboratively in order to complete the assignments given by the lecturer.

Week 5 was a ‘browsing period’ for students to choose and link their artifacts and also view their peers’ eportfolios. The researcher observed in the tutorial, the students’ interpersonal communication and collaboration among their peers and also with the lecturer.

In Week 6, the students were asked to produce an individual cover letter and resume for their eportfolios where their peers could view, and comment on, each other’s
eportfolios. During the tutorial, the researcher observed how students interacted and worked collaboratively in order to complete the assignments given by the lecturer.

In Week 7, was another ‘browsing period’ for students to choose and link their artifacts and also view their peers’ eportfolios. Again the researcher observed how the students interacted and worked collaboratively in the tutorial in order to complete the assignments given by the lecturer.

In Week 8, students were asked to produce their second reflections using the same questions that prompted them in the first reflection. Here, the researcher wanted to investigate whether the students’ reflection have shown any growth in the learning as a result of using eportfolios in their technical communication course.

In Week 9, students were asked to submit their second reflection in their eportfolios, and in Weeks 10 and 11 were asked to browse in order to choose and link their artifacts and also view their peers’ eportfolios. Once more the researcher observed how the students interacted and worked collaboratively in the tutorial in order to complete the assignments given by the lecturer.

In Week 12, students were asked to produce their third reflection in their eportfolios, with the researcher observing student interaction and collaborative work in the tutorial in order to complete the assignments given by the lecturer.

In Week 13, students were asked to submit their third reflection in their eportfolios. The researcher also administered the actual questionnaire (Learning Process Questionnaire) to students to complete within 20 minutes. This was to gauge the difference in
candidates’ responses. The researcher was available to clarify any questions from students. Each student was asked to write the code number assigned by the lab assistant earlier on top of the questionnaire and to submit the completed questionnaire to the lab technician. The researcher again observed the students’ interaction and collaborative work in completing the assignments given by the lecturer.

In Week 14, a focus group interview with five students was carried out by the researcher after the course lecturer submitted the course grade (to avoid possible coercion of the participants). Each interview took approximately 20 minutes per group. A convenient time and day for the interview was arranged for the students. The interview was carried out to confirm the students’ learning outcomes, experiences, and perceptions of the use of eportfolios. The voluntarily selected five students in the five focus groups were informed that their interviews would be conducted in a group, and the data collected would be treated confidentially, with anonymity fully assured. They were aware that, at any stage of the activities, they could withdraw from participation without any negative impact on themselves. The interviews with the students, as well as the interview with lecturer were audio recorded and subsequently transcribed for analysis. Each interview took approximately 20 minutes.

Finally, students were asked to submit their eportfolios to the lecturer and researcher and to burn their work onto CD-ROM or online.

**Data Analysis**

There were five sets of data to analyse: 66 students’ reflection entries (1st, 2nd, and 3rd entries) in their eportfolios, five sets of focus group interviews with five students in each group, an individual interview with one lecturer, two sets of Learning Process
Questionnaires administered to 66 students: preferred and actual, and observation in the classroom.

**Learning Process Questionnaire**

The two sets of Learning Process Questionnaires: preferred and actual from 66 students were analysed using Statistical Package for the Social Sciences (SPSS) version 17.0 data editor. The descriptive statistics analysis was examined to identify central tendencies and dispersions. Questionnaire responses were analysed in terms of frequency and percentage. The maximum and minimum scores, mean, standard deviation, variance, and other statistics were obtained to indicate whether the responses ranged satisfactorily over the scale. The frequency distribution of the ordinal variables was also obtained, with visual displays through bar charts. Cronbach’s alpha test of reliability was performed on each set of data to identify the internal reliability of the survey. Next, the inferential statistics were analysed to identify the relationship between the independent variable and dependent variables using paired t-test. Scale scores from the students’ preferred form and actual form of the Learning Process Questionnaire were tabulated and reported in the Findings chapter.

The comments filled in under each of the scales were analysed by the researcher. The responses to the additional question and open-ended questions were analysed and grouped according to themes to support the quantitative findings.

**Focus Group Interviews with Students**

The researcher analysed the five focus group interviews consisting of five students in each group, where the transcripts of the interview data was analysed after all interview sessions. As mentioned earlier, each student was also given a code to protect their
identity. For example, Student 1 from Group 2 was coded as (2C1). Kvale (1996) states that private information that might identify the participants will not be reported as it is classified as confidential in research. He elaborates that there is a need the change the participant’s names and identifying features in order to protect the participants’ names and identifying features in order to protect their identity, which is an important issue in the reporting of interviews. The focus group interviews with the students were all audio recorded. The digitally recorded interviews were saved as Windows Media Audio (WMA) files and were named according to the focus group interview.

The transcriptions were carried out while listening to the interview recordings, using windows media player on a computer. Audio recordings were paused regularly to confirm the written transcriptions. Hesitations such as repeated utterances, words or phrases such as “ah” and “oh” that only confused what the student was saying, were omitted. When the transcriptions were completed, the researcher began to look for the main ideas and concepts that could lead to emerging thematic categories. Thus, words and phrases related to a particular concept were carefully coded in each of the interview transcriptions. The process was repeated for all transcriptions.

**Individual Interview with the Lecturer**

The researcher analysed the interview with the lecturer. The transcript of the interview was analysed after the interview session. The interview with the lecturer was audio recorded, and the digitally recorded interview was saved as a Windows Media Audio (WMA) files and named according to the interview.

The transcription was carried out while listening to the interview recording, using Windows Media Player on a computer. Audio recording was paused regularly to
confirm the written transcription. As in the student interviews, hesitations such as repeated utterances, words or phrases such as “ah” and “oh”, that only confused what the lecturer was saying, were omitted. When the transcription was completed, the researcher began to look for the main ideas and concepts that could lead to emerging thematic categories. Thus, words and phrases related to a particular concept were carefully coded in each of the interview transcriptions.

Document Analysis

The document analyses consisted of 64 students’ 1st, 2nd, and 3rd reflection entries in their eportfolios. These entries were used for two purposes of analysis: reflection and written communication. Two students did not contribute to the reflection entries.

Written reflection analysis. For the purpose of written reflection analysis, the reflection rubric adapted from Klein (2003) in Appendix M was used to analyse the entries. The rubric consisted of four criteria: narrate, analyse, synthesize and judge, and goal setting. There were three levels: beginning, emerging, and basic. The researcher decided to use the scores of 1 point = beginning, 2 points = emerging and 3 points = basic. The researcher and her supervisor analysed these data by comparing the two sets of reflection entries from 64 engineering students titled Reflection 1 and Reflection 2. Initially the researcher planned to analyse three reflections from the students, but only managed to collect 42 students’ entries. This was because the students were allowed to produce their 3rd reflection after their final examination, as they complained that they were busy with their assignments and quizzes. Furthermore, they had to present their recommendation report on the last week of semester. The 3rd reflection was also used to gain additional information to support the quantitative and qualitative data.
**Written communication analysis.** The researcher had analysed two sets of reflection entries produced by 64 engineering undergraduates: Reflection 1 and Reflection 2. However, due to the same issues affecting number of students who produced their 3rd written reflection analysis, only 42 students produced their 3rd written communication analysis. Entries were analysed using a written communication rubric developed by Teaching and Learning Centre in Murdoch University (2004) (Appendix N) to see whether students’ written communication showed any significant difference over time.

The criteria used to analyse the entries were organisation, thought, language and expression. For each of these, there were three levels: level 1, 2 and 3. The researcher and her supervisor graded the entries for Reflection 1 and Reflection 2 according to whether they were level 1, 2 or 3. Later, the score was recorded and the number of students was tabulated according to the range of 1-1, 1-2, 1-3, 2-1, 2-2, 2-3, 3-1, 3-2, 3-3. This was done in order to determine the number of students who showed any significant change over time. Reflection 3 was also used to add additional information to support the quantitative and qualitative data.

**Observation in the classroom.** Observation by the researcher during the tutorials was focused on teamwork skills and communication skills as students engaged in the process of constructing their eportfolios. These observations were conducted during semester to examine how students managed their eportfolios, such as when they create, design, display, and other factors in the tutorial sessions. The criteria that the researcher focused on comprised how students communicated with their peers or lecturer if they had any problems, how ideas were exchanged, how the classroom learning environment engaged students in learning, how the students completed the
tasks given, and how students communicated in their group and also in pairs in getting their tasks done. Observations were analysed by the researcher using the teamwork checklist (Fortuin & Wendy, n.d.) and interpersonal communication checklist (Murdoch University, 2003) shown in Appendix O and P respectively. The research components for this study is presented in Appendix Q. Details of the results of the analysis are presented in Chapter 5 as part of the discussion of the analyses that form part of this thesis.

**Ethical Considerations**

This research study received approval from Murdoch University’s Human Research Ethics Committee (HREC), permit number 2009/090. The conduct of the research study adheres to the standards of the National Statement on Ethical Conduct in Human Research (2007), the Australian Code for the Responsible Conduct of Research (2007) and Murdoch University policies at all times. This permit gave approval for the research conducted in Malaysia.

Prior to entry into university for conducting the research, a written request for approval was made directly to the Dean of the faculty and the administrator. Information Letters were distributed to participating students (Appendix C) and lecturer (Appendix H) and consent forms were distributed to participating students (Appendix D, E, F, and G) and lecturer (Appendix I) prior to participation. The research study required a Statement of Informed Consent by all participants. The forms outlined the research study nature and purpose of the study, and emphasised the confidentiality and anonymity of participants’ responses. The forms also explained that participation was voluntary and they could withdraw at any time without discrimination or prejudice and also no penalties for non-participation. If they withdraw, all information that they had provided would be
destroyed. Strict confidentiality and anonymity were preserved throughout the research. No information was concealed and deception through participant exposure to false information or circumstances was avoided by the researcher.

The research study comprised a class of engineering undergraduates at a university in Malaysia and gathered both qualitative and quantitative data to answer the research questions. Therefore, in accordance with qualitative research methods, the researcher was acting within the ethical boundaries and parameters for the study. The researcher sought permission to access to documents, data and people. The completed data are securely stored, both in electronic and hard-copy formats in the university supervisor’s office, and will be available for a period of five years after the completion of the research and would be destroyed thereafter.

**Review**

This chapter has provided an overview of the ‘mixed methods’ methodology which attempted to seek evidence of the impact of an eportfolio in a technical communication course to enhance students’ learning in terms of communication, teamwork, and critical thinking and problem solving skills. The information gained will assist with curriculum planning. The following chapter will discuss in depth the data analysis of the findings and results of this study.
CHAPTER 5 FINDINGS

This chapter presents the main findings of the research. This research study examined the learning process in developing an eportfolio by adapting the Plan-Do-Review cycle (Pallister, 2007) as shown in Chapter 1 (p. 14) of the dissertation. Students used the model as the guide to create knowledge in their learning process when they constructed and developed their eportfolios. The model guided them to plan and understand what they need to do, collect the relevant artifacts, select and link them, review and reflect on them, and share and present them. This was an ongoing process where students used the stages in the model repeatedly whenever they needed to create or revise an artifact in order to construct their eportfolios. They interacted with their lecturer and peers when they constructed their eportfolios and worked together to plan and understand what they needed to include in their eportfolios. They were required to understand the purpose of creating the eportfolio and how the process might provide benefits to them. They then collected the relevant artifacts that would reflect on their learning, and also as a requirement for the course assessment. Following this they selected the artifacts that represent their own work and also that enhance the information of their work. They also linked other files such as Microsoft Word and JPEG into their eportfolios. The students then reviewed and reflected on the artifacts, made improvements from their peers’ feedback, and critically reflected on their own learning, and also wrote their reflection entries in their eportfolios where they reflected on what they had learned as well as their learning experiences in using the eportfolio. The last stage was to share and present the artifacts with their peers, where they were able to browse and analyse their peers’ eportfolios and critically reflect on them. This resulted in the adaptation and generation of new ideas.
The following data sources were used to answer the research questions: students’ focus group interviews, Learning Process Questionnaire, reflection entries, lecturer’s interview and the researcher’s observation in the classroom. The data were analysed using the procedures described in Chapter 4. The process of analysing the data involved identifying the recurrent themes (via thematic analysis) that appeared in the artifacts. For example, Student 1 will be classified in the narrative descriptions in the two reflection entries used to analyse written communication (WC) and reflection (R) as WC1 and R1, respectively. The researcher analysed two sets of reflection entries for written communication and reflection, produced by 64 engineering undergraduates: Written Communication 1 and Written Communication 2, and Reflection 1 and Reflection 2. Initially, the researcher planned to analyse three written communications produced by the students but managed to collect three reflections from only 42 students even though all students were originally asked to generate three reflections in the course. This was because the students were allowed to produce their third reflection after their final examination, and they complained that they were busy with their assignments and quizzes. Furthermore, they had to present their recommendation report in the last week of the semester. As a result, 22 students did not produce the third reflection.

The process of analysing the data involved identifying the recurrent themes (thematic analysis) that appeared in the artifacts: 64 narrative descriptions in the two written entries; the Learning Process Questionnaire (S1) preferred and actual forms; five transcription of students’ focus group, for example, Student 1 from Group 1 (1C1) and the lecturer’s interviews (lecturer); and field notes in the observation. All these data were then categorised into themes and sub-themes by identifying patterns and summarising them in order to bring meaning to the text. The data was triangulated to
provide a better picture of the data collected and stronger evidence to answer the research question. The findings were analysed to answer the three research questions:

(i) To what extent does an eportfolio enhance students’ communication skills?
(ii) To what extent does an eportfolio enhance students’ critical thinking and problem solving skills?
(iii) To what extent does an eportfolio enhance students’ teamwork skills?

Quantitative Data

This section examines the quantitative findings from the study instruments. The objective of the questionnaire was to elicit information on the students’ learning experience when they used the eportfolio as a learning tool in the technical communication course during one semester. The research instrument used for this survey consisted of two forms of the questionnaire: preferred and actual Learning Process Questionnaire, respectively. By using these two forms of the Learning Process Questionnaire, the researcher was able to determine any differences between students’ perceptions of their preferred and actual learning process.

Reliability

Cronbach Alpha was used as a measure of internal consistency. The Cronbach alpha, an index of internal consistency, was acceptable for all subscales, varying between .79 and .88 for the preferred form and .74 and .90 for the actual form. Wubbles (1993) noted that a scale reliability coefficient of .70 or greater was regarded as acceptable. A score was calculated for each scale as the mean of the responses to the items composing each subscale after prorating for unanswered items (Tabachnick & Fidell, 1989).
Paired T-test

To determine any differences between the students’ perceptions of the preferred and actual learning process, means, standard deviations and a paired t-test were conducted. The major finding was that there were statistically significant differences in the preferred and actual learning scores for five of the six scales: Interpersonal Communication, \( p = .01 \); Reflection, \( p = .00 \); Collaboration, \( p = .004 \); Relevance, \( p = .004 \); Challenge, \( p = .001 \). The remaining scale, Ease of Use, gave no statistically significant difference in the preferred and actual learning scores, at \( p = .92 \).

Survey Data: Preferred and Actual Learning Process Questionnaires

The findings of this section have been peer reviewed and published in a journal conference paper (Appendix R). Section I of the questionnaire confirmed that the participants in the study comprised one class of 66 students, with 56 male and 10 female undergraduates. These students were second year engineering students who took a technical communication course as a requirement of their programme. They were aged 20 to 22 years old and mostly Malays and Chinese.

Qualitative Data

The findings were summarised according to the elements of graduates attributes adopted by the researcher’s faculty in to the technical communication courses as shown in Table 2.3. The same students’ reflection entries: Reflection 1 and Reflection 2, were used to evaluate their reflection and written communication. For the purpose of written reflection analysis, the reflection rubric adapted from Klein (2003) in Appendix M was used to analyse the entries. The rubric consisted of four criteria: narrate, analyse, synthesize and judge, and goal setting. There were three levels: beginning, emerging, and basic. The researcher decided to use the scores of 1 point = beginning, 2 points =
emerging and 3 points = basic. In addition, the criteria used to analyse the written entries were organisation, thought, language and expression. For each of these, there were three levels: level 1, 2 and 3 as shown in Appendix N. The details of the criteria were discussed in Chapter 4. Thus the data was summarised and triangulated to answer the three research questions.

**Research Question 1: To what extent does an eportfolio enhance students’ communication skills?** The first research question investigated whether the use of an eportfolio in the technical communication course enhanced students’ communication skills.

The quantitative data in the *preferred* form of the Learning Process Questionnaire show that students had perceived a high level of interpersonal communication (mean = 3.81). Most of the students knew the importance of interpersonal communication as they needed the skill to pass on information, conduct meetings and maintain good relationships between the superior and subordinate. Similarly, the results of the *actual* questionnaire (mean = 3.65) show that the use of the eportfolio had an impact on students’ communication skills in the technical communication course. The results indicate a statistically significant difference in the *preferred* and *actual* learning scores of Interpersonal Communication, with p = .01.

The major themes that emerged from the data analysis were developed under the following elements of communication skills found in Table 2.3: The ability to practice active listening and respond appropriately: the ability to present ideas clearly, effectively, and confidently in oral and written forms; and the ability to present
confidently in a way that caters to the audience level. The following theme was concerned with students’ proficiency in English.

**The ability to practice active listening and respond appropriately**

*Lecturer - student communication.* Based on the researcher’s prior experience of teaching in the course, more interpersonal communication developed between the lecturer and the students when they used the eportfolio in the course than there had been before the eportfolio was introduced. This was helpful as it boosted the students’ level of confidence and helped them to produce better work as measured by the analysis of written entries in the blog at two different times (Week 4 and 9) in the semester. Most students in the current cohort were comfortable in seeking help from their lecturer as the course progressed. There were more interactions in the initial stages when students relied on their lecturer for guidance and information as they developed their eportfolios.

Based on the researcher’s experience in teaching the course, most of the students had always lacked confidence in preparing and presenting their work in English. The researcher observed that two students told their lecturer that they felt inferior as their English was not good and supported by the other twenty-seven students. As a result, they could not generate ideas and did not show improvement in their written entries in the blog, where five students attained Level 1 and fifteen students attained Level 2. In the early stages, a majority of students had difficulty in creating their eportfolios. This was confirmed in the lecturer’s interview:

> Maybe that was the first time that they were asked to do something like this. So, I think they’re a bit scare and furthermore, they’re asked to use English, they’re paranoid, and maybe I would comment on their grammar and sentence structure and so on. (lecturer)
The lecturer confirmed that this was the first time that the students were asked to create an eportfolio and they had no experience in reflecting. Therefore, most of the students found the task to be very challenging, especially as they were asked to use English which was not their first language. These same students were more comfortable seeking help from their lecturer, who was the expert in the course matter, when they had trouble in creating their eportfolios, and two students confirmed this statement in the interview:

Sometimes I feel shy to ask other members and don’t know how to ask the other members what I’ve done. So, I’ll ask my facilitator and they gave some learning to me and information to me how to do the eportfolio better. (2C2)

…as far that we all know that in eportfolio itself we can see that after posting, we can comment on certain posts and then, somehow students also can interact with the lecturer whether they have any kind of idea or any questions to ask or simple questions to ask, any ideas for the improvement for some entries itself that have been published in the eportfolio. (3C4)

The researcher observed that the majority of the students interacted with their lecturer in the initial stages when they constructed their eportfolios. As the course progressed, students generally improved their eportfolio entries. During class observation the lecturer asked if anyone needed her assistance. Two hands were raised but they said they would be fine as their peers would help them. This showed that the students were beginning to feel more comfortable working in pairs, which was confirmed in the lecturer’s interview:

And so, I did help them but most of the time, they’re more comfortable to ask help from their friends/peers. (lecturer)

The researcher noticed that the interactions between the lecturer and the students were more frequent in the beginning of semester (Week 1 to 4) and decreased as the semester progressed (Week 5 to Week 14). The majority of the students had shifted their reliance to their peers as they gained experience in handling their eportfolios. Thus, there was a shift from the lecturer to their peers when the students needed help with their eportfolios.
Students interacted mostly with their lecturer in the earlier weeks of the semester when they learned to construct their eportfolios. As all of them were new to the eportfolio, they relied on their lecturer for guidance and information. The issue of using English in constructing the eportfolio was also a challenge for most of the students as English was not their first language. Nevertheless, they gained experience in developing their eportfolios as the course progressed. The majority of the students had shifted their reliance to their peers and continued to improve their eportfolios and learning.

**Student - student communication.** As the week progressed into mid-semester, many students were seen to engage in more interaction with their peers and continued to add artifacts and information into their eportfolios. Some students had difficulty in reflecting and asked their peers for assistance, even though they had difficulty in expressing themselves well in English. Their peers were very helpful in assisting their friends to reflect and this was confirmed in the lecturer’s interview:

For example some of them didn’t know how to link their eportfolio to other website and so, their friends help them-this is how you do it. Some of them asked their friends to look at their eportfolio and asked them to give constructive comments so that they can improve on their eportfolio. (lecturer)

One student supported this view in his interview that he consulted his peers when he had problems with his work, and his written communication entries showed an improvement from Level 1 to 2:

When I had a problem or something, I didn’t understand about how to posting a blog, I’ll consult to other friends. I’ll ask for some help from other peers to help me how to do the cover letter, resume and others. (2C5)

The analysis of the written communication entries showed that there were nine students who had experience in blogging and they produced better written reflections. The researcher observed that these students were very helpful as they moved around to help
their peers with no experience when constructing their eportfolios. The majority of the students had improved their interpersonal communication when they helped their peers with their problems. One student also expressed in the questionnaire that the learning process has improved his communication skills and relationship with his peers:

When asking friends to help about the blog can help to foster relationship and help us improve the communication skill. (S41)

Some students learned to give good comments on and critique their peers’ eportfolio. The researcher observed that most of the students discussed in pairs how to insert their comments in the eportfolio and it was confirmed in the lecturer’s interview that this was a good way to improve their interpersonal skills:

… They can actually communicate clearly by using the internet and also verbally… Also, the way to develop their interpersonal skills, it also can make them be aware when they’re making comments and they can make constructive comments... (lecturer)

On the other hand, some students complained that they could not comment on and critique their peers’ work or produce good reflections as they lack English language skills. One student wrote in the questionnaire that this was a problem for him and his written communication entries remained at Level 1:

My negative experience is I’m not expert to do write the eportfolio and have a problem to speak English. (S7)

Another student supported this in the interview:

… I lack to generate an ideas and maybe the way to write the sentences is difficultly because it has lack writing in it and also lack to use the English language. So, that’s the problem that come out. (1C5)

Moreover, one student commented in the questionnaire that his comments in the eportfolio were ignored and he did not receive any feedback from his peers. He added that many of his peers had demonstrated that they lack of English competence in their eportfolios:
… my comments were ignored and no action was taken from my peers. Furthermore, my peers do not leave comments which can improve my eportfolio. Finally, I can see that many of my peers have insufficient English usage in their eportfolios. (S63)

Another student claimed in his interview that he was disappointed with receiving supportive remarks rather than quality comments:

… when they comment also, not every comment I can use the comments to improve my eportfolio because sometimes they only write there, “keep up the good work”. To me, it’s very encouraging but also, on the other side of it, it doesn’t help to improve my eportfolio. (1C1)

However, a few students stated in the interviews that they were contented with the less constructive feedback from their peers; they were happy because their peers had viewed their eportfolios:

If there’s no constructive comment that make him to improve herself and maybe for others, if we want to comment maybe the simple comment just will make, ‘there’s someone who read my blog or there’s someone who read my eportfolio’, that’s feel more happy for some of them … (1C4)

Most students wrote in their reflection entries that they received feedback from their peers and improved their ideas and artifacts in their eportfolios. One student wrote that his peers’ feedback had helped him to improve his work and his written communication entries had also showed an improvement from Level 2 to 3, and another student claimed that he began to make fewer mistakes as he learned from the feedback received from his peers:

…I think I have more ideas by doing this eportfolio…my artifacts is getting better after being commented by others and helps me improved my work. (WC20)

...In my opinion, the E-portfolio has helped me developed in usage of the English language. After a semester of maintaining my E-portfolio, I can see that I make fewer mistakes upon writing my artifacts as I have to repair my mistakes after it is commented by my peers, and lecturer. (WC63)

Similarly, two students claimed in their interview that they received constructive feedback from their peers that helped them in their learning:
My friend also come to my page and view my post and do comment on the blog. So, they helped me to improve my language, they look for any grammar mistakes so that I can improve and make correction after they’ve comment my blog...They also give good feedback and suggestions how to improve, let say my idea is to put the green colour on font and they said green is not good and maybe you should try orange or something. (2C1)

Eportfolio really help me in order to increase my communication skill level. So, I think through eportfolio, I learn on how to blogging and I learn the right way to comment on my peers’ blog, peers’ reflections and others. Eportfolio makes me learned how to communicate with others and also how to react when my friends comment and gives some critics to me. (1C2)

The majority of the students had begun to improve their interpersonal communication as they helped their peers with their problems. One student claimed in his written entry that eportfolio could be a tool in enhancing his learning. It was fun and had benefited his learning process:

Outcome for this learning we are know how to expose self to people and from there we can communicated for each other and also we can create new relationship…to learn to make this blog, students can communicate in two directions, namely to study with two-way means they are not only fun but they get benefit from the learning process. Actually this is the best way for students to study besides reading books. (WC21)

**The ability to present ideas clearly, effectively, and confidently in oral and written forms.** Most of the students interacted with their peers to improve their eportfolios. They discussed and explained their ideas to their peers through face-to-face meeting and wrote their comments in the blog. The researcher observed that they discussed and added information into their eportfolios and two students confirmed this in their reflection entries:

…I got a lot of advantages by using this eportfolio such as got change to interact other student. I also discussed with them how to improve my eportfolio and asked them to explain their ideas. They also can ask me to explained my idea and discussed their ideas with me. (WC58)

…My learning in communication skills thus far have increased upon following this course. In these assignments, my writing skills and verbal communications skills have improved yet again. Furthermore, I get to communicate more with my fellow course mates via E-portfolio by commenting on their E-portfolio pages. (WC63)
The researcher observed that some students explained their ideas to their peers. Two students said in the questionnaire that this process of learning had improved their ability to explain ideas better in the eportfolio and generated ideas to improve their eportfolios. Their written communication entries showed an increased from Level 1 to 2 and Level 2 to 3, respectively:

I have learnt how to improve my writing in English, share about cover letter and resume with friends also to improve and explain my ideas in eportfolios. (S42)

I’ve learnt new experiences, know how to blogging and express my idea just through the blog. It’s easy and quite simple, sometimes I can express my feeling to the eportfolio if doesn’t have someone to talk. Basically, it’s also compiled all about myself just with a click! (S31)

Similarly, one student revealed in the interview that he asked his peers to explain their ideas to him and another student supported this view that the use of eportfolio improved his writing skill. Their reflection entries showed an improvement of written communication from Level 2 to 3:

For me, I think eportfolio really improve my communication skill because when I post something on the blog about me or my resume and then, my friend will comment on my post. From that, I’ll ask them back what’s my mistake or something to upgrading from their comment and make my postings more, make improvement to my posting. From that, I interact to my friend and improving my communication skill. (2C3)

... Eportfolio, really improve my communication skill especially in writing skill. I can use eportfolio as a platform to improve my writing skill by posting my reflection, resume, cover letter or my personal information. Other than that, I can communicate with other followers or peers by comment on each other. (2C4)

The lecturer also expressed a similar view in the interview, commenting that students developed their written communication skills when they wrote their learning experiences in their eportfolios and received feedback from their peers:

And for the second reflection, I asked them to reflect on their experience when they had to write their cover letter, resume and the process of mock interview. At that time, I saw the interest was there. They started to open up and they upload their pictures while they were attending this mock interview; they commented on the way the lecturer interviewed them... They described a lot about their experience... They were writing about their presentation and other friends of theirs also wrote feedback regarding their presentations. (lecturer)
Some students expressed their feelings in various ways in their reflection entries. For instance, one student claimed that his English was not good, so he preferred to write his reflection in the form of a poem as this helped him to express himself better and improved his written communication skills. Another student enjoyed using different colours in his reflection entries. It was interesting to note that 29 students had improved their second written communication entry compared with their first entry. This indicated that most of the students had managed to express their ideas and feelings in the reflection entries; for example, two students wrote in their reflection entries:

Blog give me inspiration to express myself. I can talk and discuss more about surrounding with my words. Honestly, everyone have their ideas to write something that they thinks… I can write anything and give my opinion when I post the entry for my blog. Nobody can argue my word because this is mine. (WC36)

...the e-portfolio really help us improving our skills in communication skills… the e-portfolio also help us learned how to write in English with a proper grammar and gaining new information on anything that we want to know. E-portfolio is a learning place for all kind peoples. It can help us the user in many ways such as it can improve our skills in using the e-portfolio, it can help us improve our language. (WC34)

However, one student revealed in the interview that initially he had problems in expressing himself. Later, the same student admitted in the interview that he gained experience in generating ideas better in his reflection, and his reflection entries showed that he improved his written communication from Level 2 to 3:

But the eportfolio do help me to generate the reflection because many experience I can gain from the eportfolio. (1C3)

The lecturer also mentioned in the interview that students had improved their writing as they could express their ideas more clearly and critically in their reflection entries. This showed that they gained the learning experiences when writing their reflections:

… The first one was quite short and the third one is more lengthy. They managed to describe their feelings more vividly, the organisation of this reflection was also better, and also, they managed to critically reflect what
they’ve been throughout the process of making the presentation. Overall, I think they’ve learned from their experience. (Lecturer)

However, not every student could generate ideas well. One student voiced his concern in the interview about his poor command of English which hindered his ability to express himself well in his eportfolios:

> For me, because I’m very not good enough in my grammar and my writing in English. So, I enjoy to write the reflections because all the experience that I have been through when learned the subject and learned about eportfolio and so, I want to share then write the reflection although it’s hard for me to do it. So, I want everybody to know what I’ve learned and what I’ve experience. The main point actually is that English cause me don’t write very well. (1C4)

The same views were also expressed by another two students in their reflection entries. They found it hard to generate ideas in their reflection entries as they were new to blogging and not used to producing reflections, and lacked English proficiency:

> …this is my first time create a blog. So there a lot of new thing that I need to learn. I really did not have an idea what to write… I really not good enough in English. (WC13)

> Honestly, i do not feel comfortable in doing this blog and construct my eportfolio because of my lack of idea writing in English. I am really not good in grammar and my vocabulary is so suck. (WC2)

Nevertheless, the same students were willing to learn and improve their English. They managed to improve their written communication entries from Level 1 to 2:

> …But I hope I can learn and improve my English by sharing information and opinion with MY FRIENDS through this eportfolio. I also hope my communication skills will get better. (WC2)

> …I really hope with this blog I can manage to improve my English in future…(WC13)

Some students did not think that English was the cause for not being able to produce good written entries, but complained that they had a lot of activities to do in the semester. For example, one student stated in the interview and his reflection entries showed that he attained his written communication at Level 3:
…English is not the main cause why I’m not writing well in English…but I think maybe we’ve a lot of activities to do. So, maybe eportfolio can be more interesting if we don’t have more activities. (1C2)

Some students improved their English language as a result of developing their eportfolios. One student stated in the questionnaire that creating the eportfolio had improved his English communication skills and his written communication entries maintained at Level 3:

I can improve my English communication skill through this eportfolio. It has taught me that there is more to effective communication than just verbal and writing communication. After all, I have come to realize the great importance of being a good and effective communicator in our daily lives. (S58)

A similar view was supported by two students in the focus group interview, who added that the freedom to choose the artifacts had enabled them to improve their English and gain learning experience to improve communication skills. Their written communication entries showed an improvement from Level 1 to 3, and 2 to 3, respectively:

Eportfolio also provides us to show we can give and choose the artifacts that make us to improve our English. (5C3)

I think it really gives a lot of experience because usually we’re not commonly use the English language and writing in English so that this eportfolio give a chance to ours to improve our writing skill, grammar, pronunciation and something like that. And then, we can think out of boundaries so that the way we generate our new ideas… (1C5)

On the other hand, one student wrote in the written entry that some students felt that it was just a waste of time in creating an eportfolio as he did not like to write in English. However, another student claimed in his reflection entry that it was not a waste of time in creating an eportfolio:

...the most fabulous improvement that i can see in learing of this subject is i now not afraid to speak English and write in English, for me it is very big improvement... Well, creating e portfolio is not a waste of time because it gave me time to use my time on internet in a good way and not just surfing internet without objectives or purposes...it also help me to think about my mistake to others, my mistake in grammar... (WC43)
The ability to present confidently in a way that caters to the audience level.

During observation of classes, the researcher noted that many students took the opportunity to share their ideas and artifacts with their peers. This process of learning enabled them to present their artifacts to their peers and the lecturer. One student wrote in the questionnaire that this had benefited him in his learning, and his written communication entries showed an improvement from Level 2 to 3:

By using eportfolios, we have published our resume, cover letter etc. By doing so, we can share with other student what we have done and can leave a comment to others so then we can improve our work better. (S46)

One student also supported this in his interview:

Presenting in an eportfolio improves my communication skill in the way I generate my new ideas and when the friends or peers comment to my blogs so that I can improve my blogs and maybe can improve my grammars, my presentation, my writings and so on. (1C5)

Another student also confirmed this view in his written entry, and his written communication entries showed an improvement from Level 2 to 3:

…for the first experience in published and shares post to each other in English…I feel more confident in use English, but it is in writing…But overall, this E-portfolio give me an idea in how to improving my English. It is a new thing that I get, the idea in how to sharing idea, managing it and surely that our idea, our writing. (WC30)

However, the thought of sharing ideas was not accepted by every student. For instance, one student commented in the interview that he worried that his published work might cause him problems as the eportfolio was still new in Malaysia. He also worried that he might be asked to explain what an eportfolio was:

Because it just being introduce to Malaysia students and to ourselves and so, it’s very hard to get going with the flow, right? For example, we’ve to publish all of our work that have been done. Then, publish into the eportfolio and then, people will be asking share their comments and then, maybe we’ve lack of information about this eportfolio and so, how to explain this to everyone? So, maybe that’s the problem for uslah. (1C4)
Most of the students had improved their interpersonal communication skills as they were able to explain their new ideas and interact with their friends, share their ideas and artifacts with their peers, and exchange feedback with their peers. They had also learned how to post, edit and comment on their peers’ eportfolios, and understood better how to use their eportfolios and improve them. They also expressed the belief that the learning process has enabled them to foster relationships with their peers and had improved their communication skills.

There was more interaction between the lecturer and the students in the earlier weeks of the semester as all of the students were new to eportfolios and they needed guidance from their lecturer. The use of English also seemed to be an issue for some students. Later, the students had shifted their reliance to their peers once they had gained the experience of constructing their eportfolios.

**Research Question 2: To what extent does an eportfolio enhance students’ critical thinking and problem solving skills?** The second research question investigated whether the use of an eportfolio in the technical communication course enhanced students’ critical thinking and problem solving skills. This question was intended to determine whether students had the opportunities to reflect on their own learning and thinking. Students were asked to produce three reflections in the course, during Weeks 4, 9, and 13.

The quantitative data in the *preferred* form of the Learning Process Questionnaire showed that students had perceived a high level of reflection (mean = 3.94). Most of the students showed their enthusiasm in learning how to reflect as they knew the importance of reflection especially as future engineers who always need to ‘think out of the box’ and improve on existing products or services. Similarly, the results of the
actual questionnaire (mean = 3.71) show that the use of the eportfolio had an impact on students’ critical thinking and problem solving skills in the technical communication course. The results indicate a statistically significant difference in the preferred and actual learning scores of Reflection, with p = .00.

The major themes that emerged from the data analysis were taken from the elements of critical thinking and problem solving skills described in Table 2.3: the ability to expand and improve thinking skills such as elaboration, analysis, and discussion evaluation; ability to identify and analyse problems in difficult situations and make a justifiable evaluation; and ability to find ideas and look for alternative solutions. A reflection rubric was used to analyse these reflection entries. In the rubric, there were three criteria: narrate, analyse and synthesize / judge; and three levels: beginning, emerging and basic. For example, at the beginning level, students should be able to: describe an event, experience or artifacts using facts and feelings and provide relevant details; identify strengths and weaknesses of an event, experience or artifact, connect artifacts or experience to standards; clearly explain the quality of an experience, event or artifact, gives insights and state reason for judgement.

The ability to expand and improve thinking skills such as elaboration, analysis, and discussion evaluation. The researcher analysed two sets of reflection entries produced by 64 engineering undergraduates: Reflection 1 (Week 4) and Reflection 2 (Week 9). Initially, the researcher planned to analyse three reflections produced by the students. However, the researcher managed to collect three reflections from only 42 students. This was because the students were allowed to produce their third reflection after their final examination, as they complained that they were busy with their assignments and quizzes. Furthermore, they had to present their
recommendation report in the last week of the semester. As a result, 22 students did not produce a third reflection, although all students were originally asked to generate three reflections in the course.

Most of the students were new to reflection and this was a problem for students when asked to reflect in the early stage. The lecturer in his interview also confirmed that students’ first reflection was generally brief, as most of them had no experience in reflecting; also, using the English language had also proved to be an issue:

Throughout the course, I’ve given them three assignments whereby they have to reflect three times. The first reflection was on their feelings or experience of their very first step that they took while developing their eportfolio. Well, at first I was a little bit sceptical regarding their feedback of their reflection that they give. This is because most of them reflected their experience, they reflected this very briefly. Maybe that was the first time that they were asked to do something like this. So, I think they’re a bit scare and furthermore, they’re asked to use English, they’re paranoid, and maybe I would comment on their grammar and sentence structure and so on… the first reflection is quite short maybe because they’re new and they didn’t know much how to reflect. (lecturer)

Three students wrote in their first reflection entry that they were new to blogging, lacked the knowledge and did not feel comfortable writing their reflection in English.

For example, one student wrote:

...this is my first time create a blog. so there a lot of new thing that i need to learn. i really did not have an idea what to write. i really not good enough in english. so maybe there are broken english in my blog.i really hope with this blog i can manage to improve my english in future. right now its so hard to think what to write in this post. i really did not have any idea. (R13)

Similarly, two students stated in the interview that they encountered difficulties, as their grammar and writing were poor, and they lacked the experience and ideas in order to write. However, the same students believed that writing reflections had improved their way of writing and generated more ideas, and their reflection entries showed an improvement from Level 2 to 3 and remained at Level 3, respectively:

… For the first reflection, I feel a little bit lost because I don’t have any idea to write about this reflection, what experience that I’ve gained from this eportfolio
also very hard for me to thinking about the idea and for the second reflection, I’ve been familiar with the eportfolio and I feel more very confident to write the reflection and I know what to generate for the second reflection, what have been through for the eportfolio. (1C4)

Writing reflections improved my way of writing. So, before this, maybe I just write about half a page so, for the later reflection, maybe I can write about one whole page. Ok, so it means I can have a lot of ideas to share with my friends. (1C2)

Students reflected on the artifacts such as the résumé, cover letter, and recommendations that they had prepared in their technical communication course. This reflection enabled them to generate ideas and improve artifacts in their eportfolios. This was confirmed in the student’s reflection entries when 30 of the 64 students improved their reflection from Level 1 to 2, 2 to 3, and 1 to 3. Given that this number represented almost half of the total number of students, this showed that most of the students were able to reflect on their learning and generate ideas in their writings. Two students demonstrated in their reflection entries that they reflected on the selected artifact, gained the experience of reflecting in their learning and generated new ideas and found that the eportfolio was a very powerful learning tool to enhance students’ learning. Both reflection entries were maintained at Level 3:

… One of the most important aspects of the portfolio creation process was the emphasis on personal reflection. As I prepared each artifact for inclusion in the portfolio, I reflected on the process of implementation as well as the effect the artifact had on my lesson and professional development. In a broader sense, I reflected on the past, present, and future status of my career as I put together a new resume, revisited my philosophy of learning, and developed my goals for both studying and professional development… My self esteem and self-confidence will be enhanced in order to built in this eportfolio by generate a new idea at a high level. (R58)

For me Portfolio is a very powerful learning tool which gives the creator, designer and user valuable opportunities to enhance their learning. The learning is driven by the reflection that needs to take place in order to produce the portfolio itself. The ability to reflect and therefore to learn more deeply is dependent on asking oneself questions. If the learner continually bears in mind the following questions when creating their portfolio, it should have a truly positive effect on the quality of the learning. (R8)
Similarly, two students also had similar views in the interview and their reflection entries attained at Level 3 and improved from Level 2 to 3, respectively:

… for my the first reflection, eportfolio is a new thing for me… I reflect a little bit, not so many works about my doing, about what I’ve done, about the artifacts, and how to generate the eportfolio. Then the second reflection: I’ve learned about the reflection from the first reflection, when I’ve done the cover letter and résumé, and then, I’ll reflect on what I’ve learned, and I’ve learned many things in eportfolio how to do good writing how to do good résumé and good cover letter. The third reflection is about what I’ve reflect about the recommendation reports, and then, I’ll improve my verbs and writing content and gets some ideas from what I’ve learning in my eportfolio. The third reflection I do compared to other two reflections is better and more long, more reflect of my eportfolio. (2C2)

… I put the artifacts and evidence in my blog, later, I’ll view it again and review it back. So, when I viewed it, sometimes I think back why I do this and how can I do this and so, I may think just myself whether I am still in good condition or still have a weakness. So, I can reflect back to fix my weakness. I think that the eportfolio has helped me to achieve my reflection. (3C5)

Thus the student showed improvement in his reflection entries as he gained the experience of reflecting. The lecturer also confirmed this view in the interview that students were able to reflect their experiences in learning through their process of learning, and show improvement in their reflection entries:

… The difference between the first and the final reflections: The first one was quite short and the third one is more lengthy ... they can reflect on the process of learning. They managed to describe their feelings more vividly, the organisation of this reflection was also better, and also, they managed to critically reflect what they’ve been throughout the process of making the presentation. Overall, I think they’ve learned from their experience… (lecturer)

Similarly, one student wrote in his questionnaire that he learned to reflect and generate ideas. Later, he critically reflected on his peers’ eportfolio and generated new ideas. His reflection entries improved from Level 2 to 3:

Through eportfolio, we can learnt about how to generate idea, example in the blog, after gather information and view peer’s blog will generate new idea on blog. Then also can reflect about what’s the ‘things’ that we still needed to add for ourself, in resume or eportfolio. (S62)

In addition, students reflected on their artifacts and remembered their learning more clearly. Two students said in the interview that they ‘talked back’ about what they had
learned in their reflection entries. Thus, the process of describing their learning enabled them to remember their content better and avoid making the same mistakes again and their reflection entries maintained at Level 3:

Eportfolio helped us in the learning in this course technical communication, …reflection, I’ve to talk back about what I’ve learned. So, it reflects on my learning... by repeating this what I learned in class into the eportfolio, so I think it makes remember more of the content of what I’ve learned and not only reflect but I can use what I’ve learned. (1C1)

… The eportfolio is to record what we did before and so it’s like a photo that we want to keep it as memory or something. So, maybe sometimes we forget what is our reflection that we’ve done before, so through eportfolio, we can record down and write down all the things that we’ve done before and can reflect back and view back to what we’ve done recently. Sometimes we can view again and think back what we’ve done. So, maybe if there’s a mistake, we can correct and we can remember the mistake. (3C2)

The lecturer also supported the proposition that students learned to think more critically, creatively, and analytically when using eportfolio. The eportfolio helped the students to critically think of the artifacts to be included in their eportfolios:

I really think eportfolio promotes learning at a higher degree… I think eportfolio teaches them to think more critically, to be more creative and to think more analytically… when students develop their own eportfolio, the first thing that they did was they learned how to develop an eportfolio themselves, looking for artifacts, templates, how to upload their photos, assignments, music-song of their choice and some of them managed to link to other websites such as YouTube.... (lecturer)

It is important to note that not all students improved. Two students clearly stated in the interviews that they did not improve in their reflections. For one of these students, the problems of limited competence in writing and English proficiency were the causes of an inability to generate ideas well in the reflection entries:

For me, I’ve just done the two reflections, my second reflection is shorter than the first one. The first one I use about two to three hours to write, to show my feelings on the blog because that’s the first reflection and so, we can write anything we can. But the second one, I’ve to write regarding to mock interview and I don’t know how to write. (1C3)

I also have the same problem with candidate 3 because I lack to generate an ideas and maybe the way to write the sentences is difficultly because it has lack writing in it and also lack to use the English language… (1C5)
All the students were new to reflection and this was evident in their reflection entries in the early stage. Therefore, they had difficulty in reflecting in their first reflection but gradually improved on their later reflections. They critically reflected on their learning when they constructed their eportfolios, chose their selected artifacts, and published their work. They explained their feelings and experiences about their learning process when they constructed their eportfolios through their reflection entries. This process of reflecting had helped them to generate new ideas, and remember their learning more evidently. Their improvement in reflecting showed that they had learned the skill and also enhanced other skills such as writing. Nevertheless, the use of the English language in the reflection had also proved to be an issue for some students, as indicated in the quote by Student (1C5) above. Therefore, few students who lacked ideas were unable to generate well, and this resulted in very brief information in the reflection entry.

**The ability to find ideas and find alternative solutions.** Most of the students had brainstorming sessions with their peers to generate ideas. One student stated in the interview that these sessions had helped him to analyse and generate ideas. His reflection entries improved from Level 2 to 3:

Eportfolio has helped us to achieve reflection, for example we can have a comment session in the eportfolio. Through that, we can get the feedback from our peers. For example, for the ideas: how to generate and get the idea… (3C1)

Another student supported this view in his reflection entry that the opportunity to view his peer’s eportfolio had inspired him to reflect more in his learning:

... From eportfolio, i found that i got to critically reflect on my own learning, my selected artifact,my new idea present in this class, how to become a better learner, and also my own achievement. Then, I got to reflect on my learning when my browsing my friends eportfolio and also when getting feedback from them. My greatest inspiration for continued reflection was from my friend and as I observed their increased enthusiasm and awareness of their own learning, I was inspired to personally develop a more reflective view of my studying and professional development. (R58)
The lecturer added in the interview that students collaborated among themselves in the process of reflecting and gave constructive comments to improve their artifacts:

...Some of them asked their friends to look at their eportfolio and asked them to give constructive comments so that they can improve on their eportfolio. Some of them asked me regarding the way to publish their posts: how they can publish their posts... looking at their peer’s eportfolio and this has taught them to be better. They reflect their own experience and they look at other people’s eportfolio and comment on this and they can see the problems and differences between their eportfolio with others. So, in a way, they can improve themselves. ... They were writing about their presentation and other friends of theirs also wrote feedback regarding their presentations. Some of them have up loaded their videos and their friends manage to post their comments regarding the presentation. So in a way, they can reflect on the process of learning. (lecturer)

Similarly, one student wrote in his questionnaire that the feedback from his peers had enabled him to critically reflect on how to become a better learner and his reflection entries remained at Level 3:

… From eportfolios, I get know what mistakes I done when I finished done my artefact from my members comment. I get some information from the eportfolio how to do my artifacts. (S50)

However, not many students felt their peers gave them constructive feedback. Thus, one student said in the interview that he found the feedback was not helpful in order to improve his ideas in his learning:

...but for now, it’s still not really fully so much help because not all our peers will 100% help us to improve our comment and to comment on our eportfolio. Some of the comment maybe it is not really criticism and so it’s not fully helping us but it still got help... the problems that I face is first is the feedback from our peers because feedback from our peers are really less and maybe not so quality. So, this may be one of the problem that we cannot improve well in our eportfolio. (3C1)

Students reflected on their eportfolios when they analysed peers’ writings and artifacts. They also viewed their peers’ eportfolio and later, adapted and extracted their artifacts into their own eportfolio. One student said in the interview that he did not find it useful when viewing his peers’ eportfolio as he found the artifacts were similar to his eportfolio:
… viewing my peers’ eportfolio, it only help me a little bit because mainly speaking we write about the same thing, … we all did our résumé, we all go through mock interview. So, the only part which is different is the ‘others’ section, … sometimes, some people will copy from the other people’s blog... (1C1)

However, five students had a different point of view. Two students said in the interview that they found viewing peers’ eportfolio enabled them to refer to and reflect on their learning. This process of reflecting enabled them to gain some insights about their learning because they discovered their weaknesses and strengths:

For me, it really improve my learning experience because some of my friends are really good in doing this eportfolio. From viewing his or her eportfolio, I can get ideas on how to improve my eportfolio, how to add the fancy stuff such as calendar, aquarium, flowers, such as sound…. eportfolio is a addition use of resource because eportfolio provide rich opportunities for having students to reflect on their work and think about their progress in learning through periodic and often required reflection which may help students develop their learning outcomes and skills. (2C3)

For example, C2 has a better achievement in the eportfolio like writing a good article, but I don’t write as good as C2. So I begin to think: Where’s my weakness? …We also can reflect on our idea and improve on our presentation. Before this, I view C4 eportfolio, I feel that he has a lot of new ideas that I don’t produce in my eportfolio. (3C1)

The results of the actual questionnaire also supported the thesis that the use of eportfolio had an effect on the students’ critical thinking and problem solving skills. One student also found that viewing his peers’ blog had allowed him to generate new ideas and his reflection entries improved from Level 2 to 3:

Through eportfolio, we can learnt about how to generate idea, example in the blog, after gather information and view peer’s blog will generate new idea on blog. Then also can reflect about what’s the ‘things’ that we still needed to add for ourself, in resume or eportfolio. (S62)

Some students creatively and innovatively demonstrated many ways to express their views and feelings. For example, in their blog entries, they creatively used different colours and fonts (see Figure 5.1), composed a poem (see Figure 5.2), and used artifacts to express their feelings in their reflections. This showed who they were and how they
wanted to present themselves in the eportfolio, and it also demonstrates their ownership over the eportfolio.

Below are the examples of how two students expressed themselves in their reflection entries:

2nd reflection
just got back from thermodynamics’s tutorial class...2nd reflection......what should i type here......where do i begin...ermm...let’s see....

after few weeks of doing this e-portfolio....i’m gonna say that i like it...hehe...no more running to the lecturer’s office to submit my assignments...i hope, in future, the e-portfolio is used in the university...easy for everyone...i like it...i like it...hehehe...

last week, we had our mock interview...the interviewer is our lecturer Ms. H...i think, i did well and so does everybody...we also submitted our cover letter and resume...the sample of cover letter and resume of mine have been uploaded...everyone can view them...in order to finish my resume and cover letter, i google some of the examples as my guideline...it took me 2 to 3 days to finish my resume and cover letter...overall, i’m happy with my job and i hope i will pass my interview...*wink2!!*

during my interview, i was so nervous....i’m shivering and when my turn to be interviewed, i felt like the room was so hot and the aircond was turned off....my palms are sweating and there is butterfly in my stomach...no...no...not butterfly, it’s an elephant or a dinosaur...hehehe...my voice was shaking but then i manage to control my voice....i did my rehearsal the night before the interview...i did try my very very best to be the best....i really2 hope that i did well and my lecturer can see it....again...*wink2!!!*...

Figure 5.1 Student’s creativity with words and colours
Some students critically reflected on their artifacts when they managed and organised their artifacts. The process of reflecting enabled them to explain their learning experiences in a chronological way. They divided their pages, wrote their learning experiences, and inserted artifacts to enhance the information given. Two extracts of the blog are given in Figure 5.3 where a student inserted two maps to enhance the information given in his blog and another student inserted a video via YouTube in his blog to show the process of making a product. The lecturer also supported this view in the interview that students reflected on their experiences in their learning and they uploaded the selected artifacts to enhance the information in their learning:

… eportfolio helps them to organise their artifacts… they arranged their artifacts chronologically… they managed to describe their feelings more vividly, the organisation of this reflection was also better, and also, they managed to critically reflect what they’ve been throughout the process of making the presentation. (lecturer)
Figure 5.3 Students Inserted Artifacts to Enhance their Learning
Another two students wrote in their reflection entries that they developed their creativity and inserted widgets such as chat box, music, and photos in their eportfolios. Their reflection entries maintained at Level 3 and improved from Level 2 to 3, respectively:

… It also can help us to develop our creativity because we need some creative idea to design our blog. Besides that, we also learn how to express our feeling, opinion, idea, dream and etc. in our blog… (R41)

… the blogspot still got a lot of new things to be explore by me, for example i can put a chat box, put the our photo, put some note and music, and many more… (R38)

One student confirmed this view in the interview and his reflection entries showed an improvement from Level 1 to 3:

Yes, everybody has creative in their own ideas, styles and creative in their own way. So by viewing their peer’s eportfolio, does give me some ideas in improving my eportfolio and improve my skills. (4C2)

Similarly, one student wrote in the actual questionnaire that the use of eportfolio had enabled him to organise the artifacts, and his reflection entries improved from Level 1 to 2:

I have learnt to create a blog for myself. In addition I also got my artefact well organise in my eportfolios. (S49)

The following is an example of how a student organised his paragraphs when writing his reflection (see Figure 5.4):
In summary, most of the students found that viewing their peers’ eportfolio had enabled them to reflect on their learning. They analysed their peers’ writings and artifacts and compared their artifacts, and then adapted and generated new ideas and improved their artifacts in their eportfolios. They personalised their eportfolios as they took ownership of the eportfolio and also displayed their artifacts creatively with added widgets, colourful templates, and images. They claimed that eportfolio had enabled them to engage and think of their learning experiences and learned to critically reflect on their peers’ feedback on their artifacts and to provide suggestions to improve them. The experience of reflecting had made them aware of their own weaknesses and strengths. Only very few students felt their peers’ comments were not very constructive and therefore, found them not very useful for improving on their learning. Nevertheless, some students felt the not so constructive feedback was encouraging enough as they felt more motivated and more confident in accomplishing their work. Thus, the process of reflecting had improved their artifacts and learning.
The ability to identify and analyse problems in a complex situation and make a justification. Most of the students worked collaboratively and effortlessly in their respected group to solve any problems that occurred while they completed their assignments. They identified and analysed the problems and made efforts to solve them by meeting face-to-face or leaving their comments in the blog. Two students wrote in their reflection entries and their reflection entries maintained at Level 3 and improved from Level 2 to 3, respectively:

For the recommendation report, … we divided the task evenly among each other…. we met once a week to discuss the problems faced and also to add any new inputs or new ideas along the way. So far, every problem has been successfully solved, either among ourselves or we would take it to our lecturer for advice. (R63)

… From the information that was posted, we can get any feedback or comment from others about the information and we can repair the information if there was any mistakes done by examine the comment or feedback. (R5)

Most of the students critically reflected on their own learning when they edited and improved their own artifacts based on their peers’ feedback. Two students said in the interview that peers’ comments had helped them to edit and improve their work. Their reflection entries maintained at Level 3 and improved from Level 1 to 3, respectively:

The eportfolio has helped me to achieve the reflection from the artifact in the eportfolio…I also have some comments from my peers how to do the résumé in the right way. Then, they will comment me how to do my artifacts and I’ll reflect about what I’ve done from the starting if I failed, I’ll improve and then fail, again I’ll improve and then, do the résumé a better one. (2C2)

I think by eportfolio, I got critics and comments from other peers regarding my reflections. So, they critic about things that I’ve done such as meeting and writing résumé, so I’ll gain new ideas and I’ve learned something from their critics and comments. So, by that I can generate more ideas, I can reflect on the things that I’ve done about the achievement and I’ll improve myself to be a better learner and to improve myself in the future regarding the eportfolio. (5C5)

The collaboration effort with their peers in the process of reflecting had helped them to generate ideas and find solutions to improve their ideas in their eportfolios. They critically reflected on their peers’ eportfolios and generated ideas to improve their
eportfolios. They reflected on their own experiences and suggested ways to improve peers’ artifacts. They also learned to critically analyse their peers’ comment and helped them to achieve reflection and improve their eportfolios.

Research Question 3: To what extent does an eportfolio enhance students’ teamwork skills? The third research question investigated whether the use of an eportfolio in the technical communication course enhanced students’ teamwork skills. The quantitative data in the preferred form of the Learning Process Questionnaire showed that students had perceived a high level of collaboration (mean = 3.86). This is the mean for scores of the scales of: ‘I will get to reflect on my learning when browsing my peers’ eportfolio’; ‘I will get to reflect on my learning when getting feedback from my peers’; ‘I will improve my communication and feedback with peers when browsing my peers’ eportfolios’; ‘I will contribute to the content of my peers’ eportfolios’; and ‘I will improve the content of my eportfolio entries based on the feedback from my peers’. Similarly, the actual learning questionnaire responses indicate most of the students had managed to collaborate in their learning when using eportfolios in the course (mean = 3.7). This is the mean for scores of the scales of: ‘I got to reflect on my learning when browsing my peers’ eportfolios’; ‘I got to reflect on my learning when getting feedback from my peers’; ‘I have improved my communication and feedback with peers when browsing my peers’ eportfolios’; ‘I have improved the content of the eportfolio entries when browsing my peers’ eportfolios’; and ‘I have improved the content of my eportfolio entries based on feedback from my peers’. The results show a statistically significant difference in the preferred and actual learning scores of Collaboration, with p = .004. This shows that students’ expected learning had been achieved in their actual learning. Most of the students realised that collaboration is very important for engineers
as they need to interact and collaborate in order to improve their products or services in the company.

These themes were derived from the elements of teamwork skills found in Table 2.3: develop good relationship, interact and collaborate effectively to achieve the common goal; understand and take turns to be a leader and follower in a group; and understand and respect each member.

One additional data source was students’ comments in the blogs; for example, Student 7 was coded as (B7). Narrative descriptions in the blog comments were used to provide evidence of the themes and sub-themes. Students worked in their groups to create a recommendation report, which was one of the formal assessment tasks in the course. For this research, the students were asked to at least include their members in their eportfolios, so that all of them could view their artifacts in the eportfolios and share their learning. Students were asked to view and comment on their peers’ eportfolios. They followed their peers’ blog by adding their peers’ URL blogger into their eportfolios. Students also interacted with their peers and lecturer through face-to-face meetings and by leaving their comments in the ‘comments’ link at the end of each post in the blog’s entry. Further discussions revealed how collaborations between lecturer and students, and among the students, benefited students in their learning.

**Students’ relationship with the lecturer and peers.** The theme ‘Students Understand and Respect Each Member’ can be subsumed under this theme.

**Students’ relationship with the lecturer.** Most students in the current cohort were comfortable with seeking help from their lecturer as the course progressed. The
researcher observed that frequent interactions and collaborations occurred in the initial stages from Week 1 to Week 4 of the semester, when students relied on their lecturer for guidance and information as they developed their eportfolios. This was supported by the researcher’s observation that most of the students interacted well and developed good relationship with their lecturer. They were seen to ask their lecturer on numerous occasions when they had problems with their eportfolios, and they collaborated effectively with their lecturer as they wanted him to help them to improve on their eportfolios. This was also confirmed in three students’ interviews:

Sometimes I feel shy to ask other members and don’t know how to ask the other members what I’ve done. So, I’ll ask my facilitator and they gave some learning to me and information to me how to do the eportfolio better. (2C2)

... my facilitator is really helping me much in my eportfolio because sometimes I didn’t catch up what my peers do and then, when I come to class, my facilitator will helping me and teach me how to encounter my problems... (2C3)

... My first reflection, well I’m still new and so, the reflection is just like very very simple one but as I learned more about the eportfolio, and I learned more from my facilitator how to write a good reflection. (3C3)

Students used the blogs to construct their eportfolios and as the course progressed, students generally improved on their eportfolio entries. The researcher observed that the lecturer always helped and gave encouraging words to students, especially those who were new to blogging. This was helpful as it boosted the level of students’ confidence and helped them to produce better work, and this was confirmed in one student’s reflection entry:

…actually this is the first time I’m writing to my own blog. I got some shock when my beloved lecturer asks to write about personal detail and all in English. However, I realize that this is the good change to me to develop my English and learn about the new thing that relate to the new information technology. Thanks to her because encourage me!!! (R4)

During class observation, the lecturer asked if anyone needed her assistance. Two hands were raised but they said they would be fine as their peers would help them. This
showed that the students were beginning to feel more comfortable working in pairs and in groups.

**Students’ relationship with their peers.** In the class observation, the researcher noticed that the interactions and collaborations between the lecturer and the students had increased by approximately 50% at the beginning and then decreased as the semester progressed. As the weeks progressed into mid semester, the majority of the students were seen to engage in more interaction with their peers and to continue to add artifacts and information to their eportfolios. The majority of the students had shifted their reliance to their peers as they gained experience in handling their eportfolios. The researcher noted during observation of classes that some students discussed their eportfolios in groups and some students were seen browsing their peers’ eportfolio entries. Many students took advantage of the opportunity to share their ideas and artifacts with their peers as they felt more comfortable working with them. Thus, there was a shift in interaction from the lecturer to their peers when the students needed help with their eportfolios. Two students supported this view in the interview that their peers had been a great assistance to them as they had enhanced their learning. They had benefited from the collaboration as they gained the knowledge of how to develop their eportfolios:

... the first time I’m using eportfolio is hard to me because for writing a blog, I’ve no experience about it. So, with the help of my friends... I used to use the eportfolio. I think that if no collaboration for me, I can’t finish my task. So, in my opinion, collaboration actually can help our learning like learning something that we don’t know by other friends who know how to use it. So, they can share and give the ideas to us that we actually we don’t have. Like in Chinese proverb also saying that three simple people that have no education also can win more education one by sharing their ideas. (3C2)

... I get new point of view, that is, in improved our learning experience using eportfolio, peers help is very important. Well, without peers help, we don’t know or never know what our weakness is. So, if we get comment from our peers, so at that time, we can see what our weakness is. And then, we can improve it. But to get our peers help, our peers comment, we need to have
collaboration with others… So, in that way, we can get their collaboration to comment on our eportfolio. (3C3)

Another student held the same view in his reflection entry:

… I also take this opportunity to thank to my classmates who bnyak also help in making this blog. Without help from all I can not make this blog with all that there on my blog. (R34)

Similarly, some students supported their peers through encouraging remarks made in the peers’ blog. Two students wrote in their blogs’ entries:

sometimes, when we have confident enough to perform well during an interview… all is just ‘blank’… so, i think you should do more interaction with others... and i’m sure you got confident to talk to anybody... whoever the interviewer is... March 17, 2010 11:58 PM (B55)

Hi!it's good to see you publishing more entry recently.Nice and simple entry to be read.Hope to see more creative entry from you and not just restricted on academic content.The video that you included is kinda nice thing to be included.Happy blogging! March 3, 2010 1:00AM (B54)

One student commented in the interview that he had improved his ability to write and speak as the result of collaborating with his peers:

… throughout the whole semester, the thing that I notice that by doing collaborate with peers, doing reflections, and also communicate with peer… most of the tasks in the tutorial, in some way it has improved my ability in writing in English, and also enhance my communication skill, although it’s not good, increased a little bit. (3C4)

The researcher noted that some students felt more comfortable asking their peers for help when they had problems with their eportfolios. This was confirmed in the lecturer’s interview, where the students were more comfortable asking their peers to help them:

they’re more comfortable to ask help from their friends/peers. For example some of them didn’t know how to link their eportfolio to other website and so, their friends help them-this is how you do it. Some of them asked their friends to look at their eportfolio and asked them to give constructive comments so that they can improve on their eportfolio… (lecturer)
Similarly, one student (B62) posted his problem in his blog and received comments from his two peers (B54 and B55). They wrote:

... we shouldn't put fancy item into our blog since it will be use "formally"...so that still thinking using this plain and easy mode...but after viewing few of my friend about their fancy background.thinking.. should i change it? (B62)

Hi! Fancy or not, it is depend on the owner it self. Working on a formal blog does not mean that the owner restrict the template just plain.Blog being made with desired entry is shown through the world wide web.So, it probably would be read by people around the globe.Fancy in my opinion is just simply decorated without too much gadget or widget. The font use and it size should make the readers easy to read it.Avoid exaggerated decoration that would make your blog look suck and lagging to load.Girl often over decorate their blog.I'm suggest that you spend some time to look on other blog…March 15, 2010 3:57 AM (B54)

... simple but complex.. full with content.. easier to view..imagine, when a heavy blog (fancy one..) is viewed by the slowest internet connection... it's take 5 minute to finish loading all the image..for me.. i like the simplest ever template... March 17, 2010 11:28 PM (B55)

The researcher observed that few students who had experience in blogging helped their novice peers when creating the eportfolio. The analysis of the reflection entries showed that there were nine students out of 64 students who had experience in blogging and moved around in the lab to help their friends. One student confirmed this view in the interview:

If my friends have any problems and they ask me on how to solve the problem, I can give them my opinion on how to solve the problem. (1C2)

Similarly, two students who had experience in blogging confirmed in their reflection entries that they helped their peers with their eportfolios:

…as a person who became problogger i have to help my friends who were newbies in this blog arena. (R60)

… because i’m a old user of the blogger, so that i feel that the normal feature in the blog is not a problem for me, besides i can help out my friends on what i know… (R62)

The majority of the students had improved their interaction when they helped their peers with their problems. The initiatives shown by the students to help their peers markedly
impressed the researcher. Furthermore, one student expressed in the questionnaire that the learning process had enabled him to develop good relationships with his peers:

When asking friends to help about the blog can help to foster relationship and help us improve the communication skill. (S41)

Most of the students interacted and collaborated with their lecturer in the initial stage of their study as they were new to eportfolio. Thus, their lecturer was sought on many occasions to help them to construct their eportfolios. As noted earlier, later, there was a shift of reliance from their lecturer to their peers as students felt more comfortable to seek help from their peers when they had gained the knowledge and experience to construct their eportfolios. Their peers were very supportive in helping them with their problems, and the experienced peers in blogging were also helpful. The data presented here show that most of the students had gained the benefits of collaborating and had improved their learning.

**Students interacted and collaborated effectively to achieve the common goals.** Students learned to collaborate in pairs or in groups to complete the tasks given. The researcher observed that there were numerous occasions where students did not seek their lecturer’s help in completing their assignments in the course since the beginning of mid-semester. Most of the students discussed and negotiated among themselves in order to complete the tasks given. They shared their artifacts and explained their ideas to their peers, and two students confirmed in the questionnaire that this learning experience had enabled them to explain their ideas better in the eportfolio and improved their artifacts based on peers’ feedback. Peers’ feedback was very useful and encouraging for the two students commented on it below as they were able to consolidate their thinking on the eportfolio based on this feedback:

I have learnt how to share about cover letter and resume with friend also to improve and explain my ideas in eportfolios. (S42)
Using eportfolio, I can learnt to share my personal resume, my cover letter. I also can receive comment from my friend which can make my comprehension more better. (S44)

Most of the students helped their friends to improve their artifacts; one student wrote in his comment in the blog:

…Thanks because having your time to view my blog. I just wanted to let you know how much I appreciate your comment as well. It was especially generous of you to let me improve my English skill communication and built in my self confident. Your comment really means a lot to me. Thank you for giving me the chance to succeed on this blog! March 13, 2010 11:04 (B58)

Similarly, the researcher observed that some students shared their learning and added information into their eportfolios. They viewed their peers’ artifacts and then compared their artifacts and this was confirmed in the lecturer’s interview:

the students had reflected on their own experience and they viewed at other peers’ eportfolio and gave their comments. Thus, they could make a comparison through the eportfolio as they could see the problems and differences between their eportfolio with others. So, in a way, they could improve themselves. They could learn from their peers when they viewed the artifacts and templates uploaded by their peers. (lecturer)

Two students wrote in their reflection entries that they were able to comment on and exchange their information through their eportfolio and improved their artifacts:

… I got a lot of advantages by using this eportfolio... i also can discussed with them how to improve my eportfolio and asked them to explain their ideas. They also can ask me to explained my idea and discussed their ideas with me… (R58)

…I think I have more ideas by doing this eportfolio…my artifacts is getting better after being commented by others and helps me improved my work. (R20)

The researcher observed that the majority of students negotiated with other students and continuously helped their peers to get their tasks done. They helped each other and gave ideas to their peers. Two students said in the interview that they had improved the contents of their eportfolios when they cooperated and brainstormed with their peers:

… eportfolio have helped me to think about my learning in this semester...It also helped me to teach each other and in the same way, they’ll teach me how to
organize or changing or doing new to the eportfolio… I can see the confidence level is increasing drastically... (3C3)

Yes, in collaboration really improve my learning because for me, we cannot stand alone to studying or learn something without got any help or collaboration from friends or lecturers. So, with collaboration, I got many great ideas from many people and maybe I can think extraordinary ideas. (2C4)

The researcher observed that most of the students discussed in pairs how to insert their comments into their eportfolios. Students were able to give comments to and critique their peers as they had updates in the blogger system and received feedback from their peers to enhance their learning. Two students confirmed this in the interview:

With blogger system, we can know that when some of other peers can update their eportfolio, so they can update of each eportfolio like they have put new article. So, when new updates, I just click on their eportfolio and view their artifact or article... I put some information and idea to improve my peers so that they can improve me... This is called win-win situation. (2C1)

… After created the eportfolio, actually it can link between us with our peers. For example, we’ve the follower function in the eportfolio, so we can view and know what that is currently happen and what they’re going to do and also can comment that… So, this is the benefits after developing an eportfolio. (3C1)

At the same time, the lecturer expressed in the interview that this was a good way to improve on their interpersonal skills and eportfolios through collaboration:

Students could communicate clearly by using the internet when they commented on their peers’ eportfolio and also verbally when they were in the tutorial sessions. This is a good way of developing their interpersonal skills as it also could make them be aware when they were commenting on their peers’ eportfolio. They could also give comments to improvise the eportfolio…
(lecturer)

Two students added in the interview that they had improved the contents of their eportfolios when they made comments to their peers when meeting face-to-face, and received feedback from them:

… write our reflection much better because like I say before, meeting face to face is such a way in collaboration tool. So, I think that’s also the better way in collaboration, not just commenting…But if we make the further initiative such as we can meet them face to face so we can know about our weakness but not in the comment in our page but we can share our idea directly. (3C5)

… My friend commenting and advice to correct them and make my eportfolio better. So, I can know where is my mistake or my weakness in my writing skill.
In this session, I can share my opinion or my ideas with my friends. Also I can know where my friend’s mistake and their weakness. We can help each other and so, that’s why I think that presenting in an eportfolio improve my communication skills. (3C5)

However, one student said in the interview that the collaboration did not help him to enhance his learning:

I have to agree with [C1] also because in collaboration, not much have improve my learning because most of us were the first time user in publishing an eportfolio itself. Most of us lack of experience in doing publishing, commenting or expressing their entries in their eportfolio… if we want to have a collaboration to improve my learning, brainstorm is the key to get a good collaboration. (3C4)

Some students also commented on their peers’ artifacts in their blog. Two students wrote:

your font size is too small. it hard to read. please use a bigger size of font.
nobody dont want to visit if use this size of font.
March 31, 2010 12:02 AM (B24)

i think overall your cover letter is good...but i don't really agree about one of the qualifications that you wrote...it is about the "expert in auto cadd, brige cadd, 3-D modelling....." it is best if you just write "i can do" or something else besides using "expert"...February 19, 2010 8:39 PM (B34)

A few students also encountered unfavourable experiences when using the eportfolio in the class. For example, one student wrote in the questionnaire that he received less constructive feedback on his eportfolio and therefore could not improve his blog and correct his mistakes:

Because of less people that follow me on my blog, I got less comment that it supposed to have. So, it become a problem because no people criticized me about my blog so I cannot improve my blog and repair my mistakes. (S43)

The researcher noted that some students had problems in commenting on their peers’ work. This was evident when the lecturer asked the students whether they had any problems in commenting on the work of their peers. Most of the students felt that their poor command of English had hindered their ability to do and a few students explained that they were new to eportfolio and lacked the experience of commenting and therefore
could not comment on their peers’ artifacts. One student stated in the interview that he loved to share his experience with his peers but his lack of English had let him down as he felt it was difficult to compose in his writings:

... I’m very not good enough in my grammar and my writing in English. So, I enjoy to write the reflections because all the experience that I have been through when learned the subject and learned about eportfolio, and so I want to share then write the reflection although it’s hard for me to do it. So I want everybody to know what I’ve learned and what I’ve experience. The main point actually is that English cause me don’t write very well. (1C4)

Similarly, one student complained in the interview that his peers did not give constructive feedback to help him improve his eportfolio. Thus the collaboration in the learning failed to improve his eportfolio:

... the problems that I face is first is the feedback from our peers because feedback from our peers are really less and maybe not so quality. So, this may be one of the problem that we cannot improve well in our eportfolio. (3C1)

However, few students in the interviews seemed to be content with the less than constructive feedback that they received, as they felt motivated and confident to write more as they had realised that their peers had viewed their eportfolios. Thus the collaboration enhances their learning. For example, as one student commented:

If there’s no constructive comment that make him to improve herself and maybe for others,... ‘there’s someone who read my blog or there’s someone who read my eportfolio’, that’s feel more happy for some of them, ah, because someone has read my eportfolio, so, I’ll continue to do eportfolio further time. (1C4)

Another student claimed in his reflection entry that he began to make fewer mistakes as he learned from the feedback received from his peers:

... the E-portfolio has helped me developed in usage of the English language. After a semester of maintaining my E-portfolio, I can see that I make fewer mistakes upon writing my artifacts as I have to repair my mistakes after it is commented by my peers, and lecturer. (R63)

Many students learned to share their ideas and artifacts with their peers when they published artifacts through their eportfolios. They worked collaboratively to brainstorm ideas, give comments and critique and give suggestions to improve their own and their
peers’ artifacts. They also exchanged their opinions and experiences with their peers in face-to-face meetings and through the comments in the blogs. They analysed the feedback, learned their mistakes, and improved on their artifacts as they learned the required strengths and skills from each other. Most students felt that their poor command of English had inhibited them in providing comments to their peers’ work; however these students tried to comment and gain the benefits of collaborating when constructing their eportfolios in the course. In the process, they also improved their English proficiency as they interacted more with their peers in the collaborative environment.

**Students understand and take turns to be a leader and follower in a group.**

Students were given tasks such as creating a recommendation report and meetings and they selected their members and worked collaboratively in their chosen group. Each group elected their leader whom the other members would follow and students took turns to be the leader and follower during their discussion. Two students wrote in their reflection entries how they discussed their title of their recommendation report and divided the tasks:

… after a discussion with members of the group, we have decided the title... We chose this title based on the observation of the group run by members for a month… after we finished identifying the title you want in the run, the head of the group we have to divide the task group members for our members do task well. head of the task group has been divided into five sections... (R11)

I get the idea for doing my recommendation report from the discussion between our group. … We do the task by dividing the topic into subtopic. Then, we divide the task from here… About presentation, we give this task to our leader… (R15)

The researcher noticed that all students worked collaboratively in their respective group. They brainstormed the topic of their recommendation report, and negotiated and exchanged their opinions during the discussion. Later they divided the tasks, gathered their materials, and worked collaboratively as a team to complete the set tasks and solve
any problems that occurred while they were completing their assignments. As two students wrote in their reflection entries:

… our group assignment entitled "digital watch vs analog watch" which have been selected during the brainstorming session, and this topic won among the others 5 proposed topic… we need to gather the materials to complete our recommendation report…we have divided the task (R31)

For the recommendation report, our group consists of 5 persons, thus, we divided the task evenly among each other. The division of task was done mutually and we met once a week to discuss the problems faced and also to add any new inputs or new ideas along the way. So far, every problem has been successfully solved, either among ourselves or we would take it to our lecturer for advice. (R63)

Most of the students worked collaboratively to complete the set tasks and contributed their ideas, negotiated, and interacted throughout the process of learning. They took turns to be the leader and follower and solve the problems that occurred as a team. This showed that they had played their role as leader and follower well when deciding on the topic, dividing the tasks, gathering the selected artifacts, and presenting their recommendation report.

Overall, the results suggest that students’ preferences were higher than they perceived as actually happening in the classroom. Section II findings are summarized in Figure 5.5: the preferred and actual scale mean scores. The scale means for the preferred and actual forms indicate that students generally perceive a high level of Interpersonal Communication, Reflection and Collaboration. The results show statistically significant differences for the three scales: they were, respectively, (t = 2.65, p = 0.01), (t = 4.57, p = 0.00) and (t = 2.84, p = 0.004). In spite of this, analysis of the students’ responses to the open questions suggests that most of the students’ expectations have been met with their actual learning. That is, the data from the open-ended questions supported the idea that there was no educational difference between students’ expectations (preferred form) and their experience (actual form).
In relation to the learning processes identified by the first three scales when using eportfolios in the course, students chose the scale *Often* (4) out of the five-point Likert scale. Likert scales were used in order to determine the strength of the views held by the students about the use of eportfolios. There was a general perception among the students that they were often engaged in Interpersonal Communication, Reflection and Collaboration and there were also similar results obtained for the students’ preferences. This showed that while working on their individual eportfolios, students had the opportunity to engage in the learning process with their peers and facilitator.

Figure 5.5  Scale means for *preferred* and *actual* versions of Interpersonal Communication, Reflection and Collaboration
Section III findings are summarized in Figure 5.6: the preferred and actual scale means scores for Relevance, Ease of Use and Challenge. Students generally indicated high preferences for Relevance and Challenge. The frequency of the average responses for Relevance and Challenge items was close to Often, suggesting that students expected the use of eportfolio to present information in a relevant way (mean = 3.75) and to challenge their ideas (mean = 3.93). In practice, students perceive that Often the use of the eportfolio initially presented the information in a relevant way (mean = 3.58) and was able to challenge their ideas (mean = 3.74). It is interesting to note that those students had the same mean (mean = 3.97) for their preferred and actual learning for Ease of Use.

Most students claimed the use of the eportfolio has offered authentic information in the course and is representative of real-life situations. The students were required to
produce a cover letter, resume and recommendation report as a part of the course assessment. Thus, they could present their resume, cover letter, recommendation report, article and research, which served as their authentic artifacts in their eportfolios. A paired t-test showed that the use of the eportfolio in the course did elicit a statistically significant change in actual-preferred Relevance scores (t = 2.91, p = 0.004). They could present their artifacts in meaningful ways that were meaningful and relevant to their learning. They learned to express their new ideas and present artifacts to their peers. They also received feedback from their peers and thus improved through each other’s learning. They also learned how to upload the artifacts that contained their students’ activities, organize their artifacts and published them in their blogs.

The open-ended section of the questionnaire provided additional perspectives of students’ experiences with the eportfolio, and the data were triangulated with the qualitative data and discussed in the following section.

Review

Overall, the analysis of the data suggests that the use of eportfolio had noticeably increased students’ communication skills, critical thinking and problem solving skills, and teamwork skills to the next level. In communication skills, *(the ability to practice active listening and respond appropriately)*, students interacted with their lecturer in the initial stage and later the majority of the students shifted their reliance to their peers as they gained experience in handling their eportfolios. Most of the students had gained the knowledge and learning experiences, and had generated new ideas, commented and provided critique on peers’ work, explained their ideas, and interacted with their peers. The data relating to the theme of *the ability to present ideas clearly, effectively, and confidently in oral and written forms* shows that students learned to create and develop
their eportfolios when they expressed their feelings, generated new ideas, organised the content, and used English language in oral and written forms with increased confidence. The data relevant to the theme of *the ability to present confidently in a way that caters to the audience level* shows that 29 out of 64 students (61%) had improved their written communication skills when using eportfolio in the technical communication course, as based on the analysed written entries. There were ten students who maintained at Level 3 and 15 students who maintained at Level 2. Most of the students had improved on their vocabulary, grammar, and writing in English. Nevertheless, the issue of English proficiency seemed to be an issue for some students when developing their eportfolios. They could not generate ideas and did not show improvement in their written entries. However some other students disagreed with that statement and felt that offering too many activities to complete in the semester was the cause of the problem. Most of the students had improved their communication skills when they used the eportfolio in the course. This had benefited them in their learning experience and appeared to boost their confidence level as well.

The analysis of the critical thinking and problem solving skills data suggests that the ability to expand, and improve, thinking skills such as elaboration, analysis, and discussion evaluation, the ability to identify and analyse problems in difficult situations and make a justifiable evaluation, and the ability to find ideas and look for alternative solutions had noticeably enhanced most of the students’ critical thinking and problem solving skills. In the theme *the ability to expand and improve thinking skills such as elaboration, analysis, and discussion evaluation*, most of the students had difficulty in reflecting in the early stage as they were new to reflection. Nevertheless, their perseverance and motivation to learn to reflect had shown that their efforts had paid off. The data in the theme of *eportfolio and critical thinking and problem solving skills*
showed that 30 out of 64 students (47%) had improved their reflection from Level 1 to 2, 1 to 3 and 2 to 3 when using eportfolio in the technical communication course based on the analysed reflection entries. This showed a positive result despite the fact that all of them were new to reflection. Most of the students also managed to produce longer entries as they develop their reflections, and generate new ideas in their learning. The process of reflecting had enabled them to generate new ideas and remember their learning better.

In the theme of the ability to identify and analyse problems in difficult situations and make a justifiable evaluation, most of the students reflected on their learning and revised their artifacts. They also reflected on their peers’ artifacts and provided their comments and critiques to improve their peers’ artifacts, as well as reflecting on their peers’ feedback and improving their artifacts. In the theme of the ability to find ideas and look for alternative solutions, students brainstormed ideas with peers and helped them to analyse, generate and organise ideas and artifacts in their eportfolios. Most of the students also learned to provide constructive comments and criticisms on their peers’ artifacts through collaborative effort with their peers, and how to become a better learner. Some students critically reflected on their selected artifacts and creatively designed their eportfolios, demonstrating many ways in which to express their views and display their creativity in their eportfolios; thus, this had clearly enhanced students’ critical thinking and problem solving skills. They had shown their initiative to learn and therefore gained the experience in reflecting on their learning. The positive responses also show that the students had been successful in critically reflecting on their learning: therefore, it can be argued that the use of eportfolios in the course had enhanced most of the students’ critical thinking and problem solving.
The analysis of the teamwork skills data suggests that using eportfolios had positively improved students’ teamwork skills, especially the development of good relationships and interactions with their lecturer and peers. It was also found that the majority of the students had shifted their reliance from their lecturer to their peers as they gained experience in handling their eportfolios. Students also benefited from peer collaboration learning to provide and receive comments, critically reflect on their peers’ eportfolios, generating new ideas, and keeping their learning up-to-date through browsing their peers’ eportfolios. This collaboration had enabled most of the students to gain knowledge and learning experiences and appeared to boost their confidence level when they used the eportfolio in the course. Only a minority of students found that collaboration was not useful for them as they were a lack of constructive feedback from their peers on ways to improve their eportfolios. Overall, however, students managed to collaborate successfully in their learning when using eportfolios in the course.

The findings from the quantitative data further supported the qualitative data, where the results show statistically significant differences in the preferred and actual learning scores for the three scales. Thus, all the data show that the use of the eportfolio had noticeably enhanced most of the students’ communication skills, critical thinking and problem solving skills, and teamwork skills. The students learned to brainstorm, negotiate, reflect, comment and provide critique on their eportfolios, as well as on their peers’ eportfolios. They also learned many skills such as reflecting, commenting, and critiquing in their learning process. Only a few students felt that they did not improve their learning, which appeared to be an issue due to their inadequate English language skills.
CHAPTER 6 DISCUSSION AND CONCLUSION

The purpose of this chapter is to gather the critical issues of the previous chapters together, discuss the findings and implications of this research. The results of the case study and the contributions from this research study and recommendations for further study about the use of the eportfolio to enhance graduate attributes will also be discussed in this chapter.

This research study investigates the aspects of student learning processes when students use the eportfolio in the course. The possible enhancement of graduate attributes, particularly communication skills, critical thinking and problem solving skills, and teamwork skills, is the focus of this research. The model of Plan-Do-Review cycle (Pallister, 2007) as shown in Chapter 1 (p. 14) is adapted to guide the students to develop their eportfolios and the findings were summarized under the sub skills of each of the three graduate attributes in Chapter 5. Thus this chapter will focus on the model of Plan-Do-Review cycle as the frame in the students’ learning process and the outcomes about the use of the eportfolio to enhance graduate attributes. The following data sources were used to investigate the main themes of the three research questions: students’ focus group interviews, Learning Process Questionnaire, reflection entries, lecturer’s interview, students’ comments in the blogs and the researcher’s observation in the classroom.

Discussion

The data presented in this research study showed a strong consensus among most of the students that the use of eportfolio in the technical communication course had proven to be an effective learning tool for enhancing graduate attributes namely communication skills, teamwork skills, and critical thinking and problem solving skills. The model of
Plan-Do-Review cycle (Pallister, 2007) underpins a social constructivist approach to learning is adapted into this research study as the guide for students to construct their eportfolios. This cycle involves student-centred learning and encourages students to become active, critical and reflective in their learning and take responsibility for their learning. In this research study, students used the model to plan and understand what they need to do/produce, collect artifacts, select and link artifacts, review and reflect artifacts, and share and present artifacts in their eportfolios.

**Plan and understand what you need to do/produce**

In this first stage (Plan and understand what you need to do/produce), they planned their learning where they discussed and interacted with their lecturer and peers. Through the eportfolio, they learned to blog; most of the students were new to blogging and none of them had experience in writing reflection for their learning. They discussed their eportfolios’ entries through face-to-face meeting and comments in the blogs. Thus the use of eportfolio facilitates the sharing of experiences and communication among students who are either face-to-face or at a distance (Yancey, 2001). Based on the researcher’s prior experience of teaching in the course, there was more interaction and collaboration developed between the lecturer and the students when they constructed the eportfolio in the course than they had been before the eportfolio was introduced. Thus, the majority of students were actively engaged in discussion with their lecturer and their relationship had improved as the result of an increase of 50% of their interpersonal communication and collaboration in Week 1 to 4. The lecturer’s encouragement, motivation, and constant feedback enabled students to learn in a conducive environment that encouraged active learning.
All of the students were new to reflection and this had resulted the problem of reflecting in the early stage. Most of the students’ first reflection was generally brief as they had no experience in reflecting and also, using the English language had proved to be a problem too for most of the students. The role of the lecturer was to provide regular support and feedback to students and eportfolios can facilitate students-to-students interaction and feedback from teachers (Brown, 2002). They actively collaborated in activities that involved active learning, exploration, and construction of knowledge with their peers, as well as with the lecturer, who acts as a facilitator supporting them in their learning process and constructing knowledge (Berge, 1999; Nelson, 1999) rather than passively receive information (Cole, 2000; Jonassen et al., 2003; Orlich et al., 1998). Thus the students had the authority to adopt a more active role in their learning by organizing, analyzing, synthesizing, and evaluating artifacts presented by the lecturer to them (Means, 1994). Some scholars have argued that the exceptional characteristics of educational technologies have the potential to change the role of lecturers and students (Acousta & Lui, 2006; Hanaffin & Land, 1997; Kapitzke, 2000; Spiro & Jehng, 1990; Tam, 2000; Vrasidas, 2002). Sheard and Lynch (2003, p. 2) state:

> Web-based environments can facilitate a shift in focus from teacher-centred to learner-centred education, encouraging educators to provide courses which enable students to manage their own learning. Enabling the learners more control of their learning has become the central goal or a desirable side benefit of computer technology.

Most of the students also learned to apply reflective thinking to their experiences, and generated meaning and discovered their own learning through collaboration with, and feedback from, their instructor (Lynch & Purnawarman, 2004) and in a process of using their current knowledge to construct new knowledge (McInerney & McInerney, 2002; Orlich et al., 1998). The lecturer facilitated the process of learning to create and foster an effective reflection environment for reflection (Adams et al., 2004). Reflection involves a process that needs to be cultivated in students and developed (Stone, 1998).
The use of the eportfolio had assisted students to become critical thinkers when a two-way process between students and instructor reflections on learning and feedback is included in the course (Lorenzo & Ittleson, 2005). The lecturer facilitated the process of the development of the eportfolio activities and as the course progressed, students gradually took responsibility for their own learning (Glasgow, 1997). They started to shift their reliance to their peers and this shift has indicated that they were beginning to feel more comfortable to work in pairs and in groups as they had gained the experience in handling their eportfolios. Some students generally showed improvement in their eportfolio entries as they could produce longer and thoughtful reflections and they can work independently without relying too much on their lecturer. These students showed their initiative in producing reflection entries despite having limited English. Thus, their effort had proven to be rewarding when they improved their second and third reflection entries. According to Moon (1999), reflection improves learning and practice and this supports the students’ claim where they stated that they produced longer entries, generated better ideas, and as well as increased their confidence level. Consistent with the findings on a study on teacher candidate using eportfolios (Wright, Stallworth, & Ray, 2002) and preservice teacher education (Wetzel, & Strudler, 2006) revealed that students claimed that they had improved their reflection and learned the important concepts as the result of using eportfolios.

The majority of the students claimed that collaboration had enabled them to gain knowledge and idea. The main assumption related to student learning eportfolios is that they provide opportunities to enhance student engagement, and that “the engaged learner, one who records and interprets and evaluates his or her own learning, is the best learner” (Yancey, 2001, p. 83). According to Vygotsky (1978), learning was a social process in which students enhanced their understanding through interaction with the
environment around them and they are keener on exploring concepts which are of interest to them, and discuss and negotiate the meaning of those concepts with other learners in an effective learning environment.

Most of the students also brainstormed ideas together when constructing their eportfolios, choosing their templates and artifacts for their eportfolios, writing their reflections, and completing their artifacts for course assessment such as cover letter, résumé, and recommendation report. They sought assistance from their peers to explain their ideas to them when they had problems with their selection of artifacts and construction of their eportfolios. According to Panitz (1996), collaborative learning is a learning method where each member of a group can contribute their capabilities, and share the authority and responsibility. This confirmed the statement that electronically facilitated and enhanced interactions might encourage students to articulate to others the meanings they have developed around their learning experiences, therefore gaining had a better understanding of ‘what’ and ‘how’ they have learned (Davidson & Goldberg, 2009; Gee, 2009; Jenkins, 2008; Kahne et al., 2009). Most of the students found peers’ feedback was very useful as they improved their artifacts and written communication. Their peers had suggested ways to improve their artifacts, grammatical use, and sentence structure; for example, some students suggested their peers to use different colours, templates, pictures, and fonts in their eportfolios. Student-centred learning can be observed here as students set their own goals for learning, and determine resources and activities that will help them meet those goals (Jonassen, 2000) and student-centred learning activities support the development of higher-order skills such as critical thinking and problem solving (Savery & Duffy, 1995). Thus the use of the eportfolio in this research study enabled students to engage in collaborative learning (Mason et al.,
2004) as they shared their artifacts and guided and received suggestions from their lecturer and peers (Wade & Yarbrough, 1996).

**Collect artifacts**

In the second stage (collect artifacts), students collected their relevant artifacts into their eportfolios. The majority of the students worked collaboratively to help each other to improve their artifacts and learning. The experienced students in blogging voluntarily helped their peers as they suggested and explained the information to their peers and helped them to complete the tasks given. According to Hardy, Lawrence, and Grant (2005), collaboration is an important and integral component of the learning process where the student seeks out more experienced people to help solve the task and, in doing so, obtains knowledge and experience he or she would not otherwise have had if acting individually. Scaffolding has become an important aspect to constructivist learning as more experienced students and lecturers become "scaffolds" who help and support individual students in a task and guide them until they reach a sufficient competence level (Collis et al., 2000; McLoughlin, 1999; Winnips & McLoughlin, 2001). Collaborative learning was encouraged here as students learn from their peers through mutual negotiation and communication until they reach a shared knowledge base without interference from the instructor (Lee & Wu, 2006). In this learning process, many students gained a lot of useful information when they commented and criticized, discussed and negotiated, explained and exchanged their views and ideas with their peers. They suggested ways to improve their peers’ artifacts, grammatical use, and sentence structure: like ranging from the smallest details like choosing the right colour and font size to more important details like adding more appropriate artifacts that complete the story of their peers’ eportfolio. Scholars have noted that collaborative
learning is the construction of shared understanding through interaction and problem solving with others (Crook, 1994).

The majority of the students claimed that this collaborative learning had helped them to critically analyse their peers’ comment, helped them to achieve reflection, generate ideas, learn the strengths and skills that resulted better reflection on their written entries. Some students stated that the use of eportfolio had helped them to achieve reflection; for example, they made constructive comments in their peers’ eportfolio when they analysed and reflected on their peers’ eportfolio. In addition, reflecting on learning can enhance critical thinking skills (Cook, 2004). They also gained knowledge and idea, comprehended their learning better, generated new ideas and boosted their confidence as they had made fewer mistakes and improved their artifacts. These findings confirmed the approach for students’ learning where they were only expected to find a solution to a problem, but also to explain and justify their developing ideas to others and has been well documented, with benefits such as student achievement, problem solving, and motivation (Crook, 1994). Thus the collaborative learning had enabled students to work together to improve their learning (Johnson & Johnson, 1994). Thus learning takes place in a meaningful, authentic context and is a social, collaborative activity, where peers play an important role in encouraging learning (Herrington et al., 2004).

Thus students who use eportfolios were more responsible for their learning, understand their strengths and limitations and learn to set goals (Christy & Lima, 1998; Heinricher et al., 2002; Hillyer & Lye, 1996). Most of the students said this process of learning had benefited them as they lacked of ideas, new to eportfolio, and new to reflection. The process of constructing an eportfolio is the key component of learning as it allows the students to become active learners as they set goals for learning, engage in self-
reflections, review goals periodically, and take charge for their own learning (Bransford et al., 2000; Venezky & Oney, 2004). Thus the students applied the constructivist form of learning which encourages their ownership in learning as they become active, critical and reflective, take more responsibility for their own learning and learn to construct knowledge on their own, and determine their own learning outcomes (Bransford et al., 2000; Bruner, 1986; Smagorinsky, 2001; Steinberg & Kincheloe, 1998; Vygotsky, 1987). This supported the educators’ claim that eportfolios allow students to think critically, and become active, independent and self-regulated learners (Hager et al., 2002; Mills-Counts & Amiran, 1991; Perry, 1998).

As the follower of their peers’ eportfolio, they received the latest updates in the blogger system and viewed their peers’ artifacts. This enabled them to monitor their peers’ progress and add in the artifacts that were lacking in their eportfolios. On the other hand, very few students claimed that they did not find it useful to view their peers’ eportfolio. The usefulness was very limited to them as they did the similar tasks and present the same artifacts. However, some students found that viewing their peers’ eportfolio had enabled them to be motivated when they discovered their peers’ achievement and thus, they challenged themselves to create a better eportfolio. The researcher’s previous experience in teaching the course also supported that view as the students were far more excited and had fun while developing their eportfolios in the course. Some students claimed that they became more acquainted with their peers as they learned more about them through reading their eportfolios. This process of learning also indirectly improved their relationship as they collaborated in the learning.
**Select and link artifacts**

The third stage (select and link artifacts) was students need to select and link artifacts into their eportfolios. Students learned to select relevant artifacts to be included into their eportfolios. Those artifacts were cover letter, résumé, recommendation report, photos, pictures, music, video, clock, and other application. The findings from the data analysis indicated that students were more motivated to use the eportfolios when they had the opportunities to demonstrate their credibility and integrity as an individual to tell their story in their eportfolios. This learning experience has also supported Kolb’s Experiential Learning Cycle that students would be motivated and had more valuable learning experiences if they encountered positive experiences, and likewise, negative experiences would deter students from potentially useful experiences in the future.

Students were given the freedom to select their artifacts to be included in their individual eportfolios and later link their files to their eportfolios. Blogs allow students full control and ownership over their online artifacts (Ferdig & Tramell, 2004; Goodwin-Jones, 2006). Blogs can record information about a student’s learning process: students can write their feelings and make them private or accessible by the public, which may encourage peer learning, interaction, and support (Hall & Davison, 2007; Walker, 2005). Reflective learning will be most effective when the contents are personal and ‘owned’ by the student (McMullan, 2008). As Charlesworth and Home (2004, p. 3) state,

> When eportfolio advocates talk of learners ‘owning their eportfolio’, they rarely, if ever, mean to base that ‘ownership’ on the legal practicalities - it is rather a rhetorical tool (mis)used to emphasise the centrality of the learner’s own experiences to the eportfolio process - the learner more accurately has some control over the use of or access to, or has legally exercisable rights over or in, the data in the system.

Researchers such as Paulson, Paulson, and Meyer (1991) and Ring and Foti (2003) have added that when students are provided an active voice in presenting evidence about the ‘what’ and ‘how’ of their accomplishment, they assume personal ownership for
improvement. This also conforms with other research on student engagement with learning suggests that when students perceive that they have choices in how to learn subject matter, they are more motivated to move beyond mere information acquisition in order to gain a deeper understanding of the subject (Entwistle, 1998; LaSere Erickson & Weltner-Strommer, 1991; Marton & Saljo, 1984; Ramsden, 2003). Most of the students love to personalise themselves in the eportfolio as they owned the eportfolio and expressed their feelings and wrote about their learning experiences in their eportfolios. They also discovered their hidden creativity and capabilities, and demonstrated them creatively and critically on their eportfolios with their selection of artifacts and templates, choice of colours and fonts, and widgets such as YouTube, videobar, and slideshow. The use of technology can be a motivating factor for the use of eportfolios because they engaged artifacts in their learning and expressed their own voice in their eportfolios (Barrett, 2004). Similarly, the findings of this research study also confirm the study where a survey carried out on 127 teacher instructors on the use of eportfolios for the preparation of new teachers in the United States by Anderson & Demeulle (1998) and found high levels of satisfaction on the usefulness of eportfolios.

By using hypertext links, students presented their artifacts and reinforced the notion of learning as a shared and interactive process with their peers into the constructed process of learning. Hartnell-Young and Morris (1999) supported this by stating that creating eportfolios with hypertext links will allow for deeper understanding and explanation through links that go from summary statements to complete documents, related items, and reflections. The eportfolio can display student work online and this is known as the ‘social action’ and ‘interactivity’ of learning (Yancey 2001, p. 20). These engineering students have the necessary web authoring skills that they have learned in the engineering course and they enhanced their skills when constructing their eportfolios.
The tool allowed the students to utilise their skills and knowledge of CAD and multimedia in demonstrating the real simulation in an interesting way. Barrett (2000) stated that an eportfolio uses electronic technologies to help students to gather and arrange artifacts in many media types such as audio, video, graphic, and text, and later reflect on what they have learnt (Fernsten & Fernsten, 2005; Gallagher, 2001; Holtzman & Dagavarian, 2007), and to examine the strengths and areas for improvement about how they learned these new skills (Ury, & McFarland, 2001).

One of the most important components of constructivist learning is to encourage the sense of ownership in learning. These findings in this research dispute the statement made by many opponents of constructivism who argue that this is a big weakness in the theory (Driscoll, 2000, p. 388-389) as they claimed that many students are not ready or able to take charge of their own learning.

**Review and reflect on artifacts**

The following stage (review and reflect on artifacts) was students need to review and reflect artifacts. Reflections are pieces of artifacts that students need to demonstrate and review the process and products of their eportfolios’ components. Students gained the experience of learning when they reflected on their reflection entries and artifacts. They also learned to critically reflect on peers’ artifacts in their eportfolios, and later gave their constructive comments and critics in order to improve their peers’ artifacts. This was done when they left their suggestions in the comments column via blogger and meeting face-to-face. They involved in active learning where they worked collaboratively with their peers and this supported McGill and Brockbank’s (2004, p. 11) view on active learning where it is defined as a “continuous process of learning and reflection that occurs with the support of a group or set of colleagues working on real
problems with the intention of getting things done”. They compared their eportfolios with their peers and critically reflected on their learning as they tried to improve their eportfolios. They generated new ideas and enhanced their creativity as they discovered new ideas to improve their artifacts, adapted their peers’ ideas and improved their artifacts, improved their English as they corrected their sentence structure, and added interesting artifacts into their eportfolios. They created their own meaning through reflection that focused on how real knowledge and information fit into the broader conceptual models or existing knowledge that they have (Bransford et al., 2000). Students stated that they remembered their learning better when they recalled their learning experiences in their reflection entries. They claimed that the use of eportfolio had taught them to be critically reflected on their learning, more confident in writing their learning experiences, honest in their writings, and critical when writing their reflection entries. They were able to identify gaps in knowledge skills and competence in the reflective process (Grant & Dornan, 2001) and also reconfirm and display evidence of strengths, skills, and knowledge (Harris et al., 2001). This research study had provided the empirical evidence to support the Zubizaretta’s claim. Zubizaretta (2004, p. 15) states,

The essential purpose of the eportfolio is to improve student learning by providing a structure for students to reflect systematically over time on the learning process and to develop the aptitudes, skills and habits that come from critical reflection.

However, there were some issues brought up by a few students. Six students only reported some negative experiences such as limited English, poor internet connection, time consumed to view peers’ eportfolio, and lack of knowledge in editing their eportfolios. One of the issues was they were afraid of giving honest comments and critics as they might intimidate and anger their friends; but less constructive feedback would not improve their eportfolios. Thus, this was a dilemma for few students to give ‘honest’ comments and critics on their peers’ work. Another issue was few students
complained that their comments were ignored and no feedback given by their peers, and they felt disappointed as they could not improve their eportfolios. The majority of the students felt inferior as their English was not good and therefore, they could not comment on their friends’ work. Initially, some students were a little sceptical when they were asked to construct their eportfolios using the English language. This was because English was not their first language and they found it very challenging. Based on the researcher’s experience in teaching the course, most of the students had always lacked the confidence in preparing and presenting their work in English. However, these students showed the effort to give comments and critics on their peers’ artifacts despite having the insufficient English. Most of the students claimed that the use of eportfolio had enabled them to improve their English as they interacted and discussed with their peers: they exchanged opinions, negotiated meaning, generated idea, and suggested ways to improve their learning. Only few students were let down with their peers’ less constructive feedback as they could not improve their artifacts and learning. Few students did not improve their reflections as they faced with the problems of limited competence in writing and English proficiency that hindered their ability to generate idea well in the reflection entries. They lacked the idea and did not feel comfortable to write their reflections in English. In addition, their reflection entries showed no improvements over the period of learning. Few students claimed that it was time consuming to view their peers’ eportfolio. Many students complained that they had a hectic schedule as they were busy with assignments and tests in the semester that hinders them to spend more time to construct their eportfolios, writing reflections, and give comments and critics to their peers’ eportfolios. Therefore, they had less discussion and interaction with their peers; they did not produce good eportfolio; did not comment and critic on their peers’ eportfolio; and demonstrated poor results in their reflection entries.
Share and present artifacts

The last stage (share and present artifacts) was students need to share and present artifacts in their eportfolios. All students shared their eportfolios in their respected group. The use of the eportfolios enabled students to identify and reflect on the outcomes of learning experiences, produce archives and presentations, and make particularly appealing through the use of multimedia. Based on the researcher’s experience in teaching the course, most of the students had always lacked the confidence in preparing and presenting their work in English. However, the use of the eportfolio had enhanced their motivation because students feel proud over the work they produce (Driscoll, 2000; Genesee & Upshur, 1996; Tosh et al., 2005). They proudly shared their artifacts, achievements, and ideas and their peers gave their comments and critics on their artifacts. They had used the eportfolios to show their capabilities and enhance their competencies (Milman & Kilbane, 2005). According to Jonassen (1996), the construction of an eportfolio shows the central features such as the complex thinking and creativity of the students. The students create and maintain their electronic repository of different files and use them to demonstrate competence and reflection on their learning. Students can better understand of their individual growth, learning, and career planning when they have access to their records, electronic repository, feedback, and reflection. Researchers such as Paulson, Paulson, & Meyer (1991) and Ring & Foti (2003) have recommended that, when students are allowed an active voice in presenting evidence regarding their accomplishments, they assume personal ownership over improvement. As Jafari and Kaufman (2006, p. 7) noted,

Those involved in learning and training are looking for tools to transform the learning experience, to enable learners to become autonomous and enjoy a truly personalized development path. It is our view that the e-Portfolio is one of the most significant tools for achieving this goal at all levels. It will support the realization of ‘portfolio career’ and act as an instrument for social inclusion, allowing all to ‘tell their story’ and celebrate their achievements.
Few students suggested ways to encourage their peers to comment on their eportfolios. They suggested to be more proactive by giving comments to their peers’ eportfolio and hopefully, their peers would comments on their eportfolios. The findings in this research study also confirmed the studies carried out by Bartell et al. (1998) that the use of eportfolios was very useful for teacher trainees in displaying their artifacts and evidence showing their talent and capability in the State of California. A number of theorists have supported that learners construct their own knowledge (Bransford et al., 2000; Bruner, 1986; Smagorinsky, 2001; Steinberg & Kincheloe, 1998; Vygotsy, 1987). Most of the students claimed that they had improved their oral and written communication skills in English as they exchanged their opinions and experiences with their peers. The collaboration with peers had enabled them to be more confident to speak and write in English.

**Implications of the Study**

The findings of the research study have implication for university administrators, faculties, policy makers, and researchers.

**For university administrators**

It is hoped that the positive results of this study will provide useful information to university administrators as input to review, study, and reassess their present engineering curriculum. This research study showed that the lecturer acts as a facilitator to facilitate the learning environment. Here, the role of the lecturer as the facilitator with the aim of helping students to achieve their learning objectives. The lecturer monitored the progress of the students and only intervened where it was necessary. The students became active learner in the learning process where they took charge of their learning. Student-centred learning should be encouraged as they were able to take charge of their
learning as they reflected on their learning process, and collected artifacts to present their achievements and learning in the eportfolio. They were given the freedom to choose the artifacts and information to be included in their eportfolios as long as the minimum content requirements are met. They felt a more positive connection with their eportfolios when it was personalised and also showed their ownership over the eportfolio and had complete control over who has access to the artifacts in them. They claimed that the use of eportfolio had given them chance to engage and think of their learning when they needed to gather the relevant artifacts in their eportfolios. They were more motivated to use the eportfolios when they had the opportunities to demonstrate their credibility and integrity as an individual to tell their story in their eportfolios. They demonstrated their hidden talents when they creatively and critically reflected on their selection of artifacts and templates, choice of colours and fonts, and widgets such as YouTube, videobar and slideshow into their eportfolios. They also enhanced the impact of their learning when they inserted maps, brochures, slideshow, video bar, and YouTube and linked their files into their eportfolios. By using hypertext links, students presented their artifacts and reinforced the notion of learning as a shared and interactive process with their peers into the constructed process of learning. The eportfolio allowed the students to utilise their skills and knowledge of CAD and multimedia in demonstrating the real simulation in an interesting way. Some students claimed that it was interesting and fun to engage in discussion when using the eportfolio in the course. The eportfolio also introduced a new way for lecturers to collect students’ work. Lecturers do not need to carry those heavy printed students’ assignments as they are able to give the feedback electronically via eportfolio.

Many students were amazed and disbelieving when they were asked to use the blog as a learning tool in the course to construct their eportfolios. This was really a new discovery
for the students in this study, who always thought that a blog could only be used as a social tool. Thus, this was definitely a new learning experience for the students of using the blog to construct the eportfolio that had enabled them to gain many benefits. The findings showed that many students claimed that they learned better and improved their learning through the process of reflection when they browsed and analysed their peers’ eportfolio, and critically reflected peers’ feedback on their learning to improve their artifacts. This reflection helps them to generate knowledge and new ideas through the activities when developing their eportfolios. The increased confidence they gained when writing their reflections showed that they had learned the skills to critically reflected, compare their peers’ artifacts and their artifacts in the eportfolio and enabled them to discover their own strengths and weaknesses.

The eportfolio serves as a learning tool to enhance students’ learning when students critically reflected on their learning and wrote the learning experiences gained from constructing meaning from the work and selecting the artifacts, and document their learning process. The process of reflection helped students to reinforce their learning, particularly when using CAD to demonstrate the engineering concepts and mechanisms. They also claimed to remember their learning better when they talked about their learning experiences in their reflection entries. They claimed that the use of eportfolio had taught them to critically reflected on their learning, be more confident in writing their learning experiences, be honest in their writings, and be critical when writing their reflection entries. Their reflection entries had shown improvement over the semester as they had critically reflected on their peers’ eportfolios and thus adapted their ideas and generated new ideas to improve their eportfolios. Many students learned to critically reflect on their learning when they received comments and critics from their peers and also learned to give constructive comments and critics on their peers’ artifacts. The
majority of the students claimed that this collaborative learning had helped them to critically analyse their peers’ comment, help them to achieve reflection, learn the strengths and skills that resulted better reflection on their written entries and thus improve their learning. Peer learning also enhanced their learning when they collaborated actively in discussion and construction of their eportfolios. Most of the students had also improved their communication skills when they use the eportfolio in the course. Thus an eportfolio had the potential to enhance graduate attributes.

The model of Plan-Do-Review (Pallister, 1997) assisted students to plan and understand what they need to do/produce, collect artifacts, select and link artifacts, review and reflect artifacts, and share and present artifacts in their eportfolios. Students planned their learning and engaged in active learning with their peers and lecturer when they discussed their eportfolios’ entries through face-to-face meeting and comments in the blogs. They collaborated with their peers to help each other to improve their artifacts and learning where they brainstormed ideas together to discuss templates, artifacts, and reflection entries and also suggested ways to improve their peers’ artifacts, grammatical use, and sentence structure. Thus this collaborative learning had helped them to plan, analyse, generate ideas, and add useful information into their eportfolios. Most students felt that their poor command of English had hindered them to give good comments about their peers’ work. But these students tried to comment and gain the benefits of collaborating when constructing their eportfolios in the course. They also improved their English proficiency as they interacted more with their peers in the collaborating environment.

The analysis of the teamwork skills data suggested that eportfolio had positively improved students’ teamwork skills especially development of good relationship and
interaction with the lecturer and peers. Many students benefited from the collaboration learning with peers as they gained knowledge and learning experiences when they critically reflected on their own artifacts, peers’ artifacts and peers’ feedback, gave comments and critics to improve peers’ artifacts, and improved oral and written communication with peers and lecturer. They also improved networking and able to keep up-to-date learning when browsing peers’ eportfolios and appeared to boost their confidence level as well. As the follower of their peers’ eportfolio, they received the latest updates in the blogger system and viewed their peers’ artifacts. This enabled them to monitor their peers’ progress and add in the artifacts that they lack in their eportfolios. Some students stated that they felt excited as they were able to keep track of their progress of learning and peers’ learning as they could receive the latest updates in their eportfolios. They would not worry if they absent from attending the course as they would be updated with the recent learning. Only a few students found that collaboration was not useful as they were lack of constructive feedback from their peers to improve on their eportfolios. Overall, the students managed to collaborate successfully in their learning when using eportfolio in the course.

Some students were motivated by their peers’ achievement and thus, they challenged themselves to create a better eportfolio. They compared their eportfolios with their peers and critically reflected on their learning as they tried to improve their eportfolios. Thus they generated new idea and enhanced their creativity as they discovered new ideas to improve their artifacts, adapted their peers’ ideas and improved their artifacts, improved their English as they corrected their sentence structure, and added interesting artifacts into their eportfolios. Some students claimed that they became more acquainted with their peers as they learned more about them through reading their eportfolios about their achievements, artifacts, and information. This showed that the use of eportfolio had
enhanced their interactions and improved their relationships as they gradually learned more about their peers.

Most of the students agreed that they were more organised when they used eportfolios in the course. Some students felt that the use of eportfolio had promoted learning at a higher degree as they learned to create, manage, and organise their eportfolios and also insert the relevant artifacts to tell the story of themselves in the eportfolio. They were more creative and critical about their selected artifacts and planned their layout and presentation of their eportfolios. They decorated their eportfolios with the chosen templates and artifacts; for example, they arranged their artifacts chronologically and divided their eportfolios into different sections and paragraphs. This also enabled them to retrieve their artifacts easier when they had an organised eportfolio. Thus they would not fear that they might misplace or lose their files as they could store their achievements in their eportfolios, add and edit information easily, and accessible to them. The eportfolio had introduced a new way for students to keep their files in a safe place and save the paper. Students can easily upgrade the content of eportfolios and update from time to time as they progress through the semester, where they can keep track of their courses, projects and reflect on their assignments and their development as engineers. They created and maintained their electronic repository of different files and used them to demonstrate competence and reflection on their learning. Besides, they were able to connect their educational experience and present their skills and talents as engineers when they use their eportfolios to showcase their achievements in the interview. Students can use the eportfolio as a tool for life-long learning and professional development as they owned their eportfolios.
Nevertheless, the issue of English proficiency seemed to be an issue for some students when developing their eportfolios. They could not generate ideas and did not show improvement on their written entries. But for some other students who disagreed with that statement and found that too many activities to complete in the semester were the cause to the problem. They were busy and thus could not spend more time in developing their eportfolios. This had benefited them in their learning experiences and appeared to boost their confidence level as well. They could see their learning progress in their eportfolios and the positive impact on their learning proved that the use of eportfolio had inevitably showed that it had the potential to be a learning tool. Thus the use of an eportfolio has shown to have a potential to enhance graduate attributes and for university lecturers who want to embed technology in the university course.

**For faculties**

Students’ positive response towards constructing an eportfolio signified an opportunity for its potential for professional development. Many students claimed that the use of eportfolio had improved their graduate attributes and enabled them to document their learning and achievements. These findings confirmed the approach for students’ learning where they were only expected to find a solution to a problem, but also to explain and justify their developing ideas to others and has been well documented, with benefits such as student achievement, problem solving, and motivation (Crook, 1994). Lee and Tan (2003) noted that the important deficiencies identified in Malaysian engineering graduates were interpersonal communication, project planning/scheduling, people management, problem solving, and team management, and this has also been a concern for the researcher’s university. Thus the findings in this research showed that the use of the eportfolio had the positive impact on students’ learning as they improved their communication skills, critical thinking and problem solving skills, and teamwork.
skills. Students, who use eportfolios were more responsible for their learning, understand their strengths and limitations and learn to set goals (Christy & Lima, 1998; Heinricher et al., 2002; Hillyer & Lye, 1996).

An eportfolio should be fully embedded into the curriculum and cannot be used as an add-on to achieve the optimum result. Therefore, the current technical communication syllabus should be revised in order to embed eportfolio and encourage engineering students to apply their knowledge and the skills learnt such as CAD and other devices in their engineering courses. Previously, the students were unable to express their ideas clearly and well on paper if they had a three-dimensional model, apart from their poor communication and presentation skills: therefore their excellent ideas could not be understood and this hindered their motivation to undertake the course. Thus the use of eportfolio allowed students to utilise the skills and knowledge in CAD and multimedia in demonstrating the real simulation in an interesting way and support their learning. As engineers, the researcher believes that the students need to be equipped with the eportfolio as a tool to help them to be more creative and design authentic tasks and present them vividly to the intended audience who could be their lecturers, peers, employers, and public. Engineering students at university should be explicitly taught reflection so that they can reflect and think critically on their assignments and improve themselves professionally. This is because these students need to be creative in order to invent or create new ideas in the future, and also engineers need to display their work to impress their future employers.

Eportfolio should be used as formative assessment to support continuous learner improvement and also present data for analysing institutional performance. Stiggins (1994, p. 87) suggested that an eportfolio is “a means of communicating about student growth and development” and “not a form of assessment”. Thus students should be
given the opportunity to choose the artifacts to be included in their eportfolios throughout a semester. The findings showed that students felt a more positive connection with their eportfolios when it was personalised and also showed their ownership over the eportfolio and had complete control over who has access to the artifacts in them. They claimed that the use of eportfolio had given them chance to engage and think of their learning when they needed to gather the relevant artifacts in their eportfolios. They were more motivated to use the eportfolios when they had the opportunities to demonstrate their credibility and integrity as an individual to tell their story in their eportfolios. They demonstrated their hidden talents when they creatively and critically reflected on their selection of artifacts and templates, choice of colours and fonts, and widgets such as YouTube, videobar and slideshow into their eportfolios. They also enhanced the impact of their learning when they inserted maps, brochures, slideshow, video bar, and You Tube and linked their files into their eportfolios. The artifacts in the eportfolio are reviewed with the students and used to provide feedback to improve learning. This formative assessment also able to collect students’ voice, which reflects their ‘honesty’ in their reflective writing as students have been known to refuse having their reflections assessed (Tosh et al., 2005). It is also believed that learning is a result of the physiological development of the individual (according to developmental theory), and therefore the main concern will be the process of constructing the eportfolio rather than the end product of the eportfolio (Smith & Tillema, 2003).

Faculty deans and other university administrators need to take into account the amount of time involved in constructing an eportfolio embedded into the course. The workload and time management should be considered for both students and faculty when embedding an eportfolio into the syllabus as the eportfolio process take a great deal of time for all individuals involved. The findings also found that students complained that
they were busy with their assignments and other activities. As a result, they lacked the attention to construct their eportfolios, unable to browse and comment on peers’ eportfolio and artifacts, and unable to generate well in their reflection entries. Besides, the faculty also need to make sure that the availability of computer sufficient to accommodate the number of students who will be using the eportfolio in the course. It is also recommended that the faculty pay attention to the network issues in order to make the eportfolio accessible to students.

**For higher education policy makers**

The findings revealed the pedagogical value of using an eportfolio as a learning tool represents the students’ growth and learning as they stored their artifacts which contained their assignments and reflections and can be used as accreditation materials. Engineering students have been found to lack communication and teamwork skills (Mills & Treagust, 2003). Thus there is a need to embed an eportfolio into the course to enhance graduate attributes among the undergraduates. Eportfolios were developmental in their nature because they could document students’ growth and learning. Therefore, they should be utilized in short-term goal attainment and long-term learning outcomes. Eportfolio allowed cross-referencing of student work through hyperlinks. Thus, the eportfolio could be used to create links between all the different kinds of work that is to be presented. In addition, the process of constructing and publishing the eportfolio can be viewed as a type of collaboration. Thus for higher education policy maker, it is highly recommendable to use an eportfolio to enhance graduate attributes.

**For researchers**

This research study suggested strongly that future research in this area should include students’ voice. This type of research is important as the use of eportfolio had proven to
enhance graduate attributes namely communication skills, critical thinking and problem solving skills, and teamwork skills.

This research also showed that the process of learning is emphasised rather than the end product. The constructivist learning: relying on the behaviourist theory for summative results is fine as the theory looks at the product but the socio-constructivist approach is needed to underpin the formative ongoing process. Students should be given the freedom to choose their artifacts and control over their eportfolios as the way they like it. The use of the eportfolios and lecturer guidance would help students to plan and organise their work. By assisting students to set specific goals and helping them see these through, the students will become motivated toward continued progress. When students see their achievement, they begin to realise that they have improve and motivate them to learn further.

This research suggested that future research in this area should emphasise formative assessment as it showed the beneficial. Learning is a result of the process of constructing the eportfolio rather than the end product of the eportfolio. Thus summative assessment only tends to change the contents as students were reluctant to include their personal incidents. This is because they only want to write what their lecturer would want them to write for the assessment purpose. Therefore, reduce the value of real learning from the students.

The adaptation of the model Plan-Do-Review (Pallister, 2007) underpins a social constructivist approach to learning that allows student-centred learning where students have to become active, critical and reflective in their learning and take responsibility for their learning. Students actively engaged in constructing eportfolios and gained the
experience of the learning by planning, selecting, reflecting, and sharing the artifacts. The testing of the model can contribute to our knowledge base in relation to the application of enhancing learning, and is particularly valuable for other researchers who want to incorporate eportfolio into their study, or for practitioners who wish to embed eportfolio into their practice.

The researcher utilized the open source common tools such as Google’s blogger platform because the students are familiar with blogs and students can control over who has access to the artifacts in them. This allows students to have flexibility to choose, design and create their artifacts in their own creative ways as they have been equipped with the necessary web authoring skills from their engineering course and it is simple to manipulate as the user interface is easy to understand, create and edit, as well as, user-friendly and accessible. Templates were also available for those students who needed guidance in the initial stage. Furthermore, it is free and easy to set up, manage and update blogs frequently and without additional support; low cost as no software and licence are needed and blogs do not require expertise from the staff to maintain them. Therefore, the researchers should be able to utilise an eportfolio to achieve graduate attributes.

**Contributions of the Study**

This research study has contributed in many ways. The eportfolio has contributed to our understanding of the benefits of eportfolio as a tool to enhance graduate attributes. It has shown its effectiveness as a learning tool as it offers new insights into the students’ learning process as it has enhances the graduate attributes namely communication skills, critical thinking and problem solving skills, and teamwork skills. Thus this research study has contributed to the research about the effect of the use of eportfolio on
graduate attributes in the Malaysian higher education sector. This research has collected authentic data from the voices of the students and the lecturer as evidence to prove that the use of eportfolio enhanced graduate attributes. This study will therefore

The adaptation of the model Plan-Do-Review (Pallister, 2007) underpins a social constructivist approach to learning that allows student-centred learning where students have to become active, critical and reflective in their learning and take responsibility for their learning. Students actively engaged in constructing eportfolios and gained the experience of the learning by planning, selecting, reflecting, and sharing the artifacts. The testing of the model can contribute to our knowledge base in relation to the application of enhancing learning, and is particularly valuable for other researchers who want to incorporate eportfolio into their study, or for practitioners who wish to embed eportfolio into their practice.

Students should be given the freedom to choose their materials as they had the ability to take charge of their learning. This also enabled them to have student ownership in learning as they manage their own learning experiences. The lecturer will be the facilitator to monitor the progress of the students and only intervenes where it is necessary. When students have the sense of ownership over their eportfolios, they were motivated and personalised themselves in the eportfolio. They then began to demonstrate their hidden talents when they creatively and critically reflected on their selection of artifacts and templates, choice of colours and fonts, and widgets such as YouTube, videobar, and slideshow into their eportfolios.

Samples of students’ reflection entries were collected as the data showed the evidence that the use of an eportfolio has the significant potential as a tool to enhance students’
reflection. The literature on eportfolios stresses on reflection where it was considered as the most important component in an eportfolio. This research study gave the empirical evidence to support Zubizaretta’s (2004, p. 15) claim that

“The essential purpose of the electronic portfolio is to improve student learning by providing a structure for students to reflect systematically over time on the learning process and to develop the aptitudes, skills and habits that come from critical reflection”.

**Limitations of the Study**

The number of participants in the research study was relatively small, only 66 students and one lecturer in one university. Therefore, it may not be representative of the entire population of engineering students. Future research with more participants in a range of universities will be encouraged to give a better overall result to represent the students in the programme.

The results of the research are likely to be applicable to the engineering field only as the students involved are engineering students. All data collected from one of the universities in Malaysia. Therefore, the results of the study would likely be limited to universities in Malaysia and not other countries.

**Conclusion**

The growing emphasis on graduate attributes in higher education has posed a global concern and the issue of undergraduates who lack graduate attributes has been highlighted in the literature. Thus this study has contributed to our understanding of how the use of an eportfolio embedded into a technical communication course can enhance students’ graduate attributes namely communication skills, critical thinking and problem solving skills, and teamwork skills, among engineering undergraduates in a
The data collected from the students’ experiences and voices showed the evidence that majority of the students had definitely improved their communication skills, critical thinking and problem solving skills, and teamwork skills. Many students claimed that the use of eportfolio had enhanced their learning in many ways. The model of Plan-Do-Review (Pallister, 1997) had enabled them to plan and understand what they need to do, collect the relevant artifacts, select and link the artifacts, review and reflect on the artifacts, and share and present their artifacts in response to their interests, requirements, and understanding. The mixed methods allowed data to be triangulated to provide a better picture of the data collected (Lincoln & Guba, 1984). The case study incorporated a number of data gathering techniques, including preferred and actual questionnaires, focus group interviews with students and an interview with the lecturer, observation and document analysis to analyse the learning outcomes, and experiences and perception of the use of eportfolio in enhancing the communication, teamwork, and critical thinking and problem solving in the course.

Most of the students claimed that the use of the eportfolio in the course had enabled them to gain a lot of experiences and knowledge in the learning process. They had enhanced their interpersonal skills in oral and written forms when they interacted with their peers: they brainstormed ideas, gave and received constructive comments and critics to improve artifacts and generated new ideas in their eportfolios. The collaboration with peers had enabled them to be more confident to speak and write in English. Students-centred learning can be observed here as students actively collaborated in activities that involved active learning, exploration, and construction of knowledge with their peers, as well as with the lecturer, who acts as a facilitator supporting them in their learning process and constructing knowledge (Berge, 1999; Nelson, 1999) rather than passively receive information (Cole, 2000; Jonassen et al., ...)
Orlich et al., 1998). The role of the lecturer was to provide regular support and feedback to students and eportfolios can facilitate students-to-students interaction and feedback from teachers (Brown, 2002). Students had shifted their reliance to their peers when they had gained the experience of constructing the eportfolio. Most of the students worked collaboratively to compare their artifacts when they viewed their peers’ artifacts in the eportfolio. Thus the collaborative learning enabled them to discover their strengths and weaknesses, and improve their learning. This confirms with the finding of Hismanoglu and Hismanoglu (2010) who found that students gained the benefits of the experience of reflecting in the eportfolio and helped them to develop skills in self-evaluation.

Most of the students claimed that the use of eportfolio had enhanced their reflecting skills when they critically reflected on their artifacts. Peer feedback had also enabled them to reflect on their learning experiences and generate new ideas, improvise artifacts, and present the artifacts creatively with added web widgets and images. Students applied reflective thinking to relate their experiences through the process of constructing an eportfolio (Barrett, 2001). They agreed that the use of eportfolio had encouraged them to reflect and gain the experience of reflecting, creative, recognised their own accomplishments through the learning goals and reflection. This is similar to the findings of Kavaliauskiene & Anusiene (2008). Thus they also gained the confidence to reflect and improve their artifacts. Thus the process of reflection helped students to construct meaning from the work and the artifacts they have selected, and the eportfolio serves as an additional aid to enhance the artifacts, particularly when using CAD to demonstrate the engineering concepts and mechanisms. Thus this research study can be used to support learning and reflection on the process of learning (Carmean & Christie, 2006; Fernsten & Fernsten, 2005), and real life experiences. They
elaborated that an eportfolio served as a repository to store their artifacts and learning experiences where they serve as evidence of their learning and achievement. This confirmed the statement made by the researchers that eportfolios have the potential to document a student’s progress over time (Brown, 2002; Young, 2002) as students used their eportfolios to document the evidence of their tasks (Foote and Vermette, 2001). They were able to keep track of their learning and edit them when it was necessary. Thus an eportfolio served as a web-based digital repository of artifacts designed to display and demonstrate the student's knowledge and performance (Greenberg, 2004). An eportfolio embodies both the process of reflecting on learning experiences and the product of verifying claimed learning outcomes (Chun, 2002).

Some students felt that eportfolio promoted learning at a higher degree. They claimed that they learned something new and improved on their learning experiences. They learned to create, manage, and organise their eportfolios and also insert the relevant artifacts to tell the story of themselves in the eportfolio. This showed their ownership of the eportfolio as they were allowed to select the relevant artifacts and creatively decorated their eportfolios with widgets. Most students felt that creating eportfolio was an invaluable experience for them as they gained the knowledge and improved on their graduate attributes such as communication skills, critical thinking and problem solving skills and teamwork skills. They also improved their vocabulary, grammar, and writing in English, motivation, confidence, blogging skills and improved on their relationship with their lecturer and peers. Thus, the bond of friendship had also helped them to look for information in the internet and improve their communication skills. Students need to acquire these necessary attributes, which are important as engineers need to manage, organize, inspire and empower their subordinates and work together to achieve the goal of the company. Thus they improved their learning experiences that enabled them to
take charge of their own learning process within the university and throughout their lives. This research study confirms the literature that using eportfolios has great potential for university lecturers, who want to embed technology in the university course (Barrett, 2005; Dibiase, 2002; Huba & Freed, 2000; Jafari, 2004; Linn & Gronlund, 2000; Williams & Jacobs, 2004; Winder, 2006). This findings support the claims by Brown (2002) and Young (2002) that it has the potential as learning tool to enhance graduate attributes and one of the possible approaches to help student attainment of graduate attributes (Christy & Lima, 1998; Engineers Australia, 2005; EPC Assessment Working Group, 2002; Love & Cooper, 2004; Rogers & Williams, 1998). Thus, the use of the eportfolio in this research study had enhanced graduate attributes among students when they engaged in the learning process of the course.

**Recommendations for Future Research Study**

From the research, there are some possible recommendations which could be carried out by the university educators, the university administrators, and the Ministry of Education to further enhance the graduate attributes.

- A study to examine the potential development of an eportfolio using other social networking service such as Facebook.com or MySpace.com. on the impact of students’ learning on graduate attributes.
- A study that looks at the effectiveness of the peer learning where peers correct their peers’ learning and evaluate whether this enhances their graduate attributes.
- A study that follow up the students’ employment where investigates the successful use of the eportfolio as a tool in helping the students to find employment. The participants in this study seemed to gain valuable knowledge and skills that might be useful in their further work. Future research might investigate the effects of eportfolio development on students’ future academic
plans and accomplishments. Similarly, studies could explore the impact of eportfolio development on students’ following work-related learning and career advancement.

- A study using an eportfolio embedded into an engineering course. The present study was conducted in an English class. Future studies could incorporate an eportfolio project in content-based classrooms to explore how students conceptualize subject matter and reflect on their learning in content-based courses.

- The present study only investigates the use of the eportfolio and the impact on the learning process that involves three graduate attributes; communication skills, teamwork skills, and critical thinking and problem solving skills. Thus another study using an eportfolio embedded into an engineering course and examine the impact of the learning on other graduate attributes such as lifelong learning & information management skills, entrepreneurship skills, ethics, moral & professional skills, and leadership skills.

- A study using an eportfolio in two groups: a control group and experimental group, to see whether the tool has any impact on students’ learning process. The same lecturer will be facilitating the course and compare students’ learning outcomes. The experimental group will receive the treatment: an eportfolio for learning, while the control group, use their time to continue with the regular activities of the classroom.

- This study involved a small sample of students. A larger sample may be able to represent the entire population of engineering students of the impact of their learning on the graduate attributes.

- A study that compares the use of the eportfolio in higher education to enhance graduate attributes in different universities.
Final Thoughts

The results of the data were well supported by the voice of the students that they had enhanced their communication skills, critical thinking and problem solving skills, and teamwork skills when they used an eportfolio in a technical communication course. Students unanimously expressed their appreciation and excitement to use the eportfolio in their course as the tool had enabled them to enhance other skills resulted from the graduate attributes. They developed their interpersonal communication when they give comments and critics on their peers’ artifacts. They also found that peer feedback was very useful as they could improve on their artifacts and written communication. They had critically reflected on their learning when they actively collaborated with their peers and lecturer through discussion and interaction face-to-face and comments in the blog. The experiences that they gained from using eportfolios enabled them to generate new ideas, critically reflect on the selected artifacts and become a better learner, and manage and organise their artifacts systematically. The use of the model Plan-Do-Review (Pallister, 1997) had enabled them to construct their eportfolios and grown academically and personally. Their achievements were archived in their eportfolios where their artifacts and activities of learning could be found. This research study proven that an eportfolio embedded into a technical communication course is an effective tool in learning as it enhances students’ graduate attributes, particularly communication skills, critical and problem solving skills, and teamwork skills. The university plays an important role in ensuring that eportfolio as a learning tool is embedded into the engineering curriculum. This is to enhance the values of graduate attributes among the engineering students as industries and employers have become more demanding in expecting engineers to possess better oral and written communication skills, teamwork skills, and critical thinking and problem solving skills. Thus, graduate attributes play an important role in shaping the engineering students to become more effective engineers,
as these graduates possess high expertise in both technical and graduate attributes and competencies they will indeed be better prepared to enter the working world.
References


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## Appendix A: Unemployment among Graduates according to Universities

<table>
<thead>
<tr>
<th>University</th>
<th>Unemployed</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Universiti Teknologi Mara</td>
<td>3,278</td>
<td>16.2</td>
</tr>
<tr>
<td>Universiti Utara Malaysia</td>
<td>1,532</td>
<td>7.6</td>
</tr>
<tr>
<td>Private Universities &amp; Colleges</td>
<td>1,217</td>
<td>6.0</td>
</tr>
<tr>
<td>Universiti Teknologi Malaysia</td>
<td>1,147</td>
<td>5.7</td>
</tr>
<tr>
<td>Universiti Kebangsaan Malaysia</td>
<td>971</td>
<td>4.8</td>
</tr>
<tr>
<td>Universiti Pertanian Malaysia</td>
<td>919</td>
<td>4.5</td>
</tr>
<tr>
<td>Other public universities</td>
<td>840</td>
<td>4.2</td>
</tr>
<tr>
<td>Universiti Malaya</td>
<td>531</td>
<td>2.6</td>
</tr>
<tr>
<td>Universiti Sains Malaysia</td>
<td>505</td>
<td>2.5</td>
</tr>
<tr>
<td>Universiti Malaysia Sabah</td>
<td>371</td>
<td>1.8</td>
</tr>
<tr>
<td>Universiti Islam Antarabangsa</td>
<td>358</td>
<td>1.8</td>
</tr>
<tr>
<td>Foreign Graduates</td>
<td>342</td>
<td>1.7</td>
</tr>
<tr>
<td>Universiti Malaysia Sarawak</td>
<td>174</td>
<td>0.9</td>
</tr>
<tr>
<td>Universiti Pendidikan Sultan Idris</td>
<td>39</td>
<td>0.2</td>
</tr>
<tr>
<td>Others</td>
<td>7,993</td>
<td>39.5</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>20,217</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
## Appendix B: Unemployment among Malaysian Graduates according to Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Unemployed</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Science</td>
<td>3,942</td>
<td>19.5</td>
</tr>
<tr>
<td>Business Administration/Management</td>
<td>3,736</td>
<td>18.5</td>
</tr>
<tr>
<td>Engineering</td>
<td>3,096</td>
<td>15.3</td>
</tr>
<tr>
<td>Accountancy</td>
<td>1,923</td>
<td>9.5</td>
</tr>
<tr>
<td>Literature &amp; Social Sciences</td>
<td>1,283</td>
<td>6.3</td>
</tr>
<tr>
<td>Pure Science &amp; Applied Sciences</td>
<td>1,303</td>
<td>6.4</td>
</tr>
<tr>
<td>Architecture &amp; Building Management</td>
<td>540</td>
<td>2.7</td>
</tr>
<tr>
<td>Agriculture, Fisheries &amp; Forestry</td>
<td>401</td>
<td>2.0</td>
</tr>
<tr>
<td>Other</td>
<td>3,993</td>
<td>19.8</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>20,217</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>
Appendix C: Information Letter for Students

Using an eportfolio to enhance graduate attributes among engineering students in Malaysia

I would like to ask you to participate in a research study looking at the use of eportfolios in a technical communication course. This study is part of my course for a Degree in Education, supervised by Dr. Dorit Maor and Dr. Renato Schibeci at Murdoch University, Australia.

Nature and Purpose of the Study
This study aims to investigate whether the use of the eportfolio will enhance engineering students’ communication skills, teamwork skills, critical thinking and problem solving skills. It will also investigate the perceptions of the students regarding the use of the eportfolio.

What the Study will Involve
If you decide to participate in this study, you will be asked to complete the following tasks:

- All students complete two questionnaires (‘preferred’ and ‘actual’) that ask about your learning experiences in using an eportfolio (interpersonal communication skills, reflection, collaboration and perceptions of the use of eportfolio). It is estimated that each questionnaire will take approximately 20 minutes to complete.
- In addition, you will have the option to be involved in ALL or SOME of the followings:
  - One focus group interview with students: 25 students will be involved in one of the five focus group interviews. You will be asked about your learning experiences in using an eportfolio (interpersonal communication skills, reflection, collaboration and perceptions of the use of eportfolio). It is estimated that each focus group session will take approximately 20 minutes.
  - Submit the required assignments to the researcher for research purposes.
  - Be involved in classroom observations: The classroom observations will be carried out during tutorials in the computer lab to find out how the students work collaboratively and use their interpersonal communication to get their tasks done in the eportfolio.

Voluntary Participation and Withdrawal from the Study
Your participation in this study is entirely voluntary. You may withdraw at any time without discrimination or prejudice. There will be no penalties for non-participation. All information is treated as confidential and no names or other details that might identify you will be used in any publication arising from the research. If you withdraw, all information you have provided will be destroyed.

If you consent to take part in this research study, it is important that you understand the purpose of the study and the procedures you will be asked to undergo. Please make sure that you ask any questions you may have, and that all your questions have been answered to your satisfaction before you agree to participate. If you do not want to take part in the project, then do not complete the consent form.
Possible Benefits of the Study
1. Opportunity to use eportfolio in learning. This may improve communication skills, teamwork skills and critical thinking and problem solving skills in the technical communication course.
2. Help you to reflect on your current learning.
3. Encourage collaboration among your peers to facilitate learning.

If you are willing to consent to participation in this study, please complete the Consent Form. If you have any questions about this project please feel free to contact either myself, Linda Khoo via email L.Khoo@murdoch.edu.au or my supervisor, Dr Dorit Maor via email D.Maor@murdoch.edu.au.

My supervisor and I are happy to discuss with you any concerns you may have on how this study has been conducted. If you wish to talk to an independent person about your concerns you can contact Murdoch University’s Human Research Ethics Committee by emailing ethics@murdoch.edu.au

A summary of the report will be available in May 2011 and if you wish for a copy, please email me: L.Khoo@murdoch.edu.au

This study has been approved by the Murdoch University Human Research Ethics Committee (Approval No. 2009/090)
Appendix D: Consent Letter for Students (Questionnaires)

Consent Form
Questionnaires

Using an eportfolio to enhance graduate attributes among engineering students in Malaysia

Participant

The information about this study has been given to me. I have received satisfactory answers to all questions I have asked. I agree to complete the questionnaires. I know that I can choose not to answer any question, or stop at any time. I understand that all information provided by me is treated as confidential and will not be released by the researcher to a third party unless required to do so by law.

___________________________________  ____________________
Signature of Participant                  Date

___________________________________  ____________________
Signature of Student Investigator        Date

___________________________________  ____________________
Signature of Chief Investigator          Date
Appendix E: Consent Letter (Classroom Observation)

Consent Form
Classroom Observation

Using an eportfolio to enhance graduate attributes among engineering students in Malaysia

Participant

I agree voluntarily to take part in this study. I have read the Information Letter provided and been given a full explanation of the purpose of this study, of the procedures involved and of what is expected of me. The researcher has answered all my questions.

I understand I am free to withdraw from the study at any time without needing to give any reason. I understand I will not be identified in any publication arising out of this study.

I understand that my name and identity will be stored separately from the data, and these are accessible only to the investigators. All data provided by me will be analysed anonymously using code numbers.

I understand that all information provided by me is treated as confidential and will not be released by the researcher to a third party unless required to do so by law. I agree to be observed in the classroom.

___________________________________  ____________________
Signature of Participant                  Date

___________________________________  ____________________
Signature of Student Investigator          Date

___________________________________  ____________________
Signature of Chief Investigator            Date
Consent Form
Document Analysis of Assignments

Using an eportfolio to enhance graduate attributes among engineering students in Malaysia

Participant

I agree voluntarily to take part in this study. I have read the Information Letter provided and been given a full explanation of the purpose of this study, of the procedures involved and of what is expected of me. The researcher has answered all my questions.

I understand I am free to withdraw from the study at any time without needing to give any reason. I understand I will not be identified in any publication arising out of this study.

I understand that my name and identity will be stored separately from the data, and these are accessible only to the investigators. All data provided by me will be analysed anonymously using code numbers.

I understand that all information provided by me is treated as confidential and will not be released by the researcher to a third party unless required to do so by law. I agree to submit and give consent to the researcher to use my assignments for research purposes.

_________________________    __________________________
Signature of Participant    Date

_________________________    __________________________
Signature of Student Investigator    Date

_________________________    __________________________
Signature of Chief Investigator    Date
Appendix G: Consent Letter (Student Focus Group Interview)

Consent Form
Student Focus Group Interview

Using an eportfolio to enhance graduate attributes among engineering students in Malaysia

Participant
I have read the participant information sheet, which explains the nature and the aim of the research. The information about this study has been given to me. I have received satisfactory answers to all questions I have asked. I have been given a copy of the information sheet to keep.

I am happy to be interviewed and for the interview to be audio recorded as part of this research. I understand that I do not have to answer particular questions if I do not want to and that I can withdraw at any time without consequences to myself.

I agree that research data gathered from the results of the study may be published provided my name or any identifying data is not used.

I understand that all information provided by me is treated as confidential and will not be released by the researcher to a third party unless required to do so by law.

___________________________________  ______________________
Signature of Participant                        Date

___________________________________  ______________________
Signature of Student Investigator                Date

___________________________________  ______________________
Signature of Chief Investigator                 Date
Appendix II: Information Letter for Instructor

Using an eportfolio to enhance graduate attributes among engineering students in Malaysia

I would like to invite you to participate in a research study looking at the use of eportfolios in a technical communication course. This study is part of my course for a Degree in Education, supervised by Dr. Dorit Maor and Dr. Renato Schibeci at Murdoch University, Australia.

Nature and Purpose of the Study
This study aims to investigate whether the use of the eportfolio will enhance engineering students’ communication skills, teamwork skills, critical thinking and problem solving skills. It will also investigate the perceptions of the students regarding the use of the eportfolio.

What the Study will Involve
If you decide to participate in this study, you will be asked to complete the following tasks:

- One interview with the researcher and it is estimated that the interview session will take approximately 20 minutes.
- Be observed in your classroom: The classroom observations will be carried out during tutorials in the computer lab to find out how the instructor assists students to work collaboratively and use their interpersonal communication to get their tasks done in the eportfolio.

Voluntary Participation and Withdrawal from the Study
Your participation in this study is entirely voluntary. You may withdraw at any time without discrimination or prejudice. There will be no penalties for non-participation. All information is treated as confidential and no names or other details that might identify you will be used in any publication arising from the research. If you withdraw, all information you have provided will be destroyed.

If you consent to take part in this research study, it is important that you understand the purpose of the study and the procedures you will be asked to undergo. Please make sure that you ask any questions you may have, and that all your questions have been answered to your satisfaction before you agree to participate. If you do not want to take part in the project, then do not complete the consent form.

Possible Benefits of the Study
While there is no guarantee that you will personally benefit, your voice about the use of eportfolios in a technical communication course will be heard by curriculum designers or policy makers through this research, thus, the knowledge gained from your participation may be useful for university instructors, who want to embed technology in the university course.

If you are willing to consent to participation in this study, please complete the Consent Form. If you have any questions about this project please feel free to contact either myself, Linda Khoo via email L.Khoo@murdoch.edu.au or my supervisor, Dr Dorit Maor via email D.Maor @murdoch.edu.au.

My supervisor and I are happy to discuss with you any concerns you may have on how this study has been conducted. If you wish to talk to an independent person about your
concerns you can contact Murdoch University's Human Research Ethics Committee by emailing ethics@murdoch.edu.au

A summary of the report will be available in May 2011 and if you wish for a copy, please email me: L.Khoo@murdoch.edu.au

This study has been approved by the Murdoch University Human Research Ethics Committee (Approval No.2009/090)
Appendix I: Consent Letter for Instructor

Consent Form for Instructor

Using an eportfolio to enhance graduate attributes among engineering students in Malaysia

Participant

I have read the Information Sheet provided and have been given a full explanation of the nature of the study. The information has been explained to me and all my questions have been satisfactorily answered. I have been given a copy of the information sheet to keep.

I am happy to be interviewed and for the interview to be audio recorded as part of this research. I understand that I do not have to answer particular questions if I do not want to and that I can withdraw at any time without consequences to me.

I agree to allow classroom observations during tutorials in the computer lab.

I agree that research data gathered from the results of the study may be published provided my name or any identifying data is not used. I have also been informed that I may not receive any direct benefits from participating in this study.

I understand that all information provided by me is treated as confidential and will not be released by the researcher to a third party unless required to do so by law.

____________________
Signature of Participant

____________________
Date

____________________
Print Name

____________________
Position

I have fully explained to _____________________________ the nature and purpose of the research, the procedures to be employed, and the possible risks involved. I have provided the participant with a copy of the Information Sheet.

____________________
Signature of Student Investigator

____________________
Date

____________________
Signature of Chief Investigator

____________________
Date
USING AN EPORTFOLIO TO ENHANCE GRADUATE ATTRIBUTES AMONG ENGINEERING STUDENTS IN MALAYSIA

This survey aims to investigate the use and integration of an Eportfolio in a Technical Communication course among engineering students in the university.

The questionnaire will be used to investigate perceptions of the use of eportfolio in the classroom environment at the university, and the results will be analysed and used in the write-up of a PhD dissertation. I am inviting you to participate because your course was selected for this study. You may decline filling in the questionnaire at any time, and you may withdraw from the study at any time.

The survey is completed anonymously and takes around 20 minutes to complete. Once completed please submit to the lab technician. All data collected in this survey will be held anonymously and securely. No personal data are asked for or retained.

If you have any further queries please do not hesitate to get in contact with the researcher at L.Khoo@murdoch.edu.au
Learning Process Questionnaire (Preferred)
Interpersonal Communication, Reflection, Collaboration and Students Perceptions about
the use of Eportfolio in Technical Communication Course

DIRECTIONS
This questionnaire comprises three sections: Section I: Background Information; Section II:
Interpersonal Communication; Reflection; Collaboration and, Section III: Students’ Perceptions
of the Use of Eportfolio.

The purpose of this questionnaire is to help us understand to what extent the use of eportfolio
has any effects on your communication skills, reflection and collaboration. You are asked to
express what you hope to achieve in the learning process. Your answers will enable us to
improve the future technical communication syllabus.

<table>
<thead>
<tr>
<th>Section I: Background Information</th>
</tr>
</thead>
</table>
Please tick (√ ) one box in each case:

Gender :
Male □  Female □

<table>
<thead>
<tr>
<th>Section II: Interpersonal Communication, Reflection and Collaboration</th>
</tr>
</thead>
</table>
The following set of statements relates to your preference of constructing an eportfolio in the Technical Communication Course and to investigate the effect on interpersonal communication skills, reflective learning and collaborative learning. Please tick (✓) ONE option that applies to you.

<table>
<thead>
<tr>
<th>1. Interpersonal Communication</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>In this class, I hope that...</th>
<th>Almost Never (1)</th>
<th>Seldom (2)</th>
<th>Sometimes (3)</th>
<th>Often (4)</th>
<th>Always (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a I will get the chance to interact with other students</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b I will discuss with other students how to improve my eportfolio</td>
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<td></td>
<td></td>
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<tr>
<td>c I will ask other students to explain their ideas</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>d Other students will ask me to explain my ideas</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e Other students will discuss their ideas with me</td>
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</tbody>
</table>

Please write any additional comments here :

________________________________________________________________________
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2. Reflection

<table>
<thead>
<tr>
<th>In this class, I hope that...</th>
<th>Almost Never 1</th>
<th>Seldom 2</th>
<th>Sometimes 3</th>
<th>Often 4</th>
<th>Always 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>a I will get to critically reflect on my own learning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b I will get to critically reflect on my selected artifacts</td>
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<tr>
<td>c I will get to critically reflect on new ideas presented in this class</td>
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<tr>
<td>d I will get to critically reflect on how to become a better learner</td>
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<td></td>
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</tr>
<tr>
<td>e I will get to critically reflect on my own achievements</td>
<td></td>
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</tr>
</tbody>
</table>

Please write any additional comments here:
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3. Collaboration

<table>
<thead>
<tr>
<th>In this class, I hope that...</th>
<th>Almost Never 1</th>
<th>Seldom 2</th>
<th>Sometimes 3</th>
<th>Often 4</th>
<th>Always 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>a I will get to reflect on my learning when browsing my peers’ eportfolio</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>b I will get to reflect on my learning when getting feedback from my peers</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>c I will improve my communication and feedback with peers when browsing my peers’ eportfolios</td>
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<tr>
<td>d I will contribute to the content of my peers’ eportfolios</td>
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<tr>
<td>e I will improve the content of my eportfolio entries based on the feedback from my peers</td>
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</tbody>
</table>

Please write any additional comments here:
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### Section III: Students’ Perceptions about the use of Eportfolio in Technical Communication Course

The following set of statements relates to your feelings about the use of an eportfolio in the Technical Communication Course. Please tick (√) ONE option that applies to you.

#### 1. Relevance

<table>
<thead>
<tr>
<th>In this class, I hope that...</th>
<th>Almost Never 1</th>
<th>Seldom 2</th>
<th>Sometimes 3</th>
<th>Often 4</th>
<th>Always 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>a I will present artifacts in meaningful ways</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>b I will present artifacts that are relevant to me</td>
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<tr>
<td>c I will present a wide range of artifacts</td>
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<td>d I will select and present realistic tasks</td>
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<td></td>
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<tr>
<td>e I will present real-life artifacts</td>
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Please write any additional comments here:
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#### 2. Ease of Use

<table>
<thead>
<tr>
<th>In this class, I hope that...</th>
<th>Almost Never 1</th>
<th>Seldom 2</th>
<th>Sometimes 3</th>
<th>Often 4</th>
<th>Always 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>a It will be easy to post and respond to entries in the eportfolio</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>b The eportfolio will be fun to use</td>
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<tr>
<td>c The eportfolio will allow tools like video, audio, images, etc to be included</td>
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<td>d It will take only a short time to learn how to use the eportfolio</td>
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<td>e It will allow easy navigation</td>
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</table>

Please write any additional comments here:
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________________________________________________________________________
In this class, I hope that the use of eportfolio will...

<table>
<thead>
<tr>
<th></th>
<th>Almost Never</th>
<th>Seldom</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>Make me reflect on my learning</td>
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<tr>
<td>b</td>
<td>Be complex but clear to use</td>
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</tr>
<tr>
<td>c</td>
<td>Be challenging to use</td>
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</tr>
<tr>
<td>d</td>
<td>Help me to generate new ideas</td>
<td></td>
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<td></td>
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<tr>
<td>e</td>
<td>Help me to generate new artifacts</td>
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</tbody>
</table>

Please write any additional comments here:

_________________________________________________________________________
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Please answer the following question

What do you hope to learn from using eportfolios in this Technical Communication course?

_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________

Thank you for your participation!
Appendix K: Learning Process Survey (Actual)

USING AN EPORTFOLIO TO ENHANCE GRADUATE ATTRIBUTES AMONG ENGINEERING STUDENTS IN MALAYSIA

This survey aims to investigate the use and integration of an Eportfolio in a Technical Communication course among engineering students in the university.

The questionnaire will be used to investigate perceptions of the use of eportfolio in the classroom environment at the university, and the results will be analysed and used in the write-up of a PhD dissertation. I am inviting you to participate because your course was selected for this study. You may decline filling in the questionnaire at any time, and you may withdraw from the study at any time.

The survey is completed anonymously and takes around 20 minutes to complete. Once completed please submit to the lab technician. All data collected in this survey will be held anonymously and securely. No personal data are asked for or retained.

If you have any further queries please do not hesitate to get in contact with the researcher at L.Khoo@murdoch.edu.au
Learning Process Questionnaire (Actual)
Interpersonal Communication, Reflection, Collaboration and Students Perceptions about the use of Eportfolio in Technical Communication Course

DIRECTIONS
This questionnaire comprises three sections: Section I: Background Information; Section II: Interpersonal Communication; Reflection; Collaboration and, Section III: Students’ Perceptions of the Use of Eportfolio.

The purpose of this questionnaire is to help us understand to what extent the use of eportfolio has any effects on your communication skills, reflection and collaboration. You are asked to comment on the actual experience of the learning process. Your answers will enable us to improve the future technical communication syllabus.

Section I: Background Information

Please tick (✓) one box in each case:

Gender : Male ☐ Female ☐

The following set of statements relates to your preference of constructing an Eportfolio in the Technical Communication Course and to investigate the effect on interpersonal communication skills, reflective learning and collaborative learning. Please tick (✓) ONE option that applies to you.

1. Interpersonal Communication

<table>
<thead>
<tr>
<th>In this class, I found that...</th>
<th>Almost Never 1</th>
<th>Seldom 2</th>
<th>Sometimes 3</th>
<th>Often 4</th>
<th>Always 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>a I got the chance to interact with other students</td>
<td></td>
<td></td>
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<tr>
<td>b I discussed with other students how to improve my eportfolio</td>
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<td></td>
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<tr>
<td>c I asked other students to explain their ideas</td>
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<tr>
<td>d Other students asked me to explain my ideas</td>
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<tr>
<td>e Other students discussed their ideas with me</td>
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</table>

Please write any additional comments here:
________________________________________________________________________
________________________________________________________________________
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234
### 2. Reflection

<table>
<thead>
<tr>
<th>In this class, I found that...</th>
<th>Almost Never</th>
<th>Seldom</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>a I got to critically reflect on my own learning</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>b I got to critically reflect on my selected artifacts</td>
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<td></td>
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<tr>
<td>c I got to critically reflect on new ideas presented in this class</td>
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<tr>
<td>d I got to critically reflect on how to become a better learner</td>
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<td></td>
</tr>
<tr>
<td>e I got to critically reflect on my own achievements</td>
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</tbody>
</table>

Please write any additional comments here:
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### 3. Collaboration

<table>
<thead>
<tr>
<th>In this class, I found that...</th>
<th>Almost Never</th>
<th>Seldom</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>a I got to reflect on my learning when browsing my peers’ eportfolio</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b I got to reflect on my learning when getting feedback from my peers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c I have improved my communication and feedback with peers when browsing my peers’ eportfolios</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d I have improved the content of the eportfolio entries when browsing my peers’ eportfolios</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e I have improved the content of my eportfolio entries based on feedback from my peers</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

Please write any additional comments here:
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
Section III: Students’ Perceptions about the use of Eportfolio in Technical Communication Course

The following set of statements relates to your feelings about the use of an Eportfolio in the Technical Communication Course. Please tick (✓) ONE option that applies to you.

1. Relevance

<table>
<thead>
<tr>
<th>In this class, I found that...</th>
<th>Almost Never</th>
<th>Seldom</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>a I have presented artifacts in meaningful ways</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b I have presented artifacts that are relevant to me</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c I have presented a wide range of artifacts</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d I have selected and presented realistic tasks</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e I have presented real-life artifacts</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Please write any additional comments here:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

2. Ease of Use

<table>
<thead>
<tr>
<th>In this class, I found that...</th>
<th>Almost Never</th>
<th>Seldom</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>a It was easy to post and respond to entries in the eportfolio</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b The eportfolio was fun to use</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c The eportfolio allowed tools like video, audio, images, etc to be included</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d It took only a short time to learn how to use the eportfolio</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e It allowed easy navigation</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Please write any additional comments here:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
3. Challenge

<table>
<thead>
<tr>
<th>In this class, I found that the use of eportfolio...</th>
<th>Almost Never 1</th>
<th>Seldom 2</th>
<th>Sometimes 3</th>
<th>Often 4</th>
<th>Always 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>a Has made me reflect on my learning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b Was complex but clear to use</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c Was challenging to use</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d Has helped me to generate new ideas</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e Has helped me to generate new artifacts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Please write any additional comments here:

___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________

Please answer the following questions

1. What have you learnt from using eportfolios in this Technical Communication course?
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________

2. Do you have any negative experience(s) from using eportfolios in this Technical Communication course? If yes, please explain.
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________

Thank you for your participation!
Appendix L: Interview Questions for Focus Group Students and Instructor

1. Interview with focus group students

<table>
<thead>
<tr>
<th>Research Objectives</th>
<th>Line of questioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. To evaluate the effectiveness of eportfolio as a tool in learning</td>
<td>Do you know what an eportfolio is? Please describe how you use eportfolio (purpose, tools, time spent, subjects or class situations, etc). What do you see as the benefits of developing an eportfolio? Is eportfolio an efficient use of resources? How easy is it to use the eportfolio?</td>
</tr>
<tr>
<td>b. To evaluate the process of learning: whether eportfolio improves students’ communication skills</td>
<td>What is communication skill? Do you think presenting in an eportfolio improves your communication skills? Please explain how your eportfolio has helped you.</td>
</tr>
<tr>
<td>c. To evaluate the impact of eportfolio on students’ critical thinking and problem solving skills</td>
<td>What is critical thinking and what are problem solving skills? How do you use your eportfolio to think about your learning? Please explain how your eportfolio has helped you. Do you think preparing eportfolio encourages you to reflect on your learning? How has the eportfolio helped you to reflect? Comment on your experiences with the reflective writing aspects of the eportfolio. Comment on your experiences with the reflective speaking aspects of the eportfolio.</td>
</tr>
<tr>
<td>d. To evaluate the impact of eportfolio on students’ teamwork skills</td>
<td>What is collaboration? Has collaboration helped you to improve your learning? If yes, how? Does viewing your peers’ eportfolio improve your learning experience? If yes, how?</td>
</tr>
<tr>
<td>e. Recommendation and any other comments</td>
<td>Would you recommend the use of eportfolio in other courses too? Any other comments?</td>
</tr>
</tbody>
</table>

2. Interview with the instructor

<table>
<thead>
<tr>
<th>Research Objectives</th>
<th>Line of questioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. To evaluate the impact of eportfolio on students’ communication skills</td>
<td>Do you think presenting in an eportfolio improves students’ communication skills? Please explain how their eportfolios have helped them.</td>
</tr>
<tr>
<td>b. To evaluate the impact of eportfolio on students’ critical thinking and problem solving skills</td>
<td>Do you think preparing the eportfolio help students to reflect on their learning? How has the eportfolio encouraged students to reflect? Comment on your experiences with the reflective speaking aspects of the learning portfolio.</td>
</tr>
<tr>
<td>c. To evaluate the impact of eportfolio on students’ teamwork skills</td>
<td>Do you think students collaborate more when they use the eportfolio? Can you please give me some examples?</td>
</tr>
<tr>
<td>d. To evaluate the effectiveness of eportfolio as a tool in learning and any other comments</td>
<td>What connections have you noticed between student eportfolio use and improved learning outcomes?</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Any other comments?</td>
<td></td>
</tr>
</tbody>
</table>
## Appendix M: A Reflection Rubric

A Reflection Rubric

<table>
<thead>
<tr>
<th>Levels: CRITERIA</th>
<th>BEGINNING (1)</th>
<th>EMERGING (2)</th>
<th>BASIC (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NARRATE</td>
<td>Describes an event, experience or artifact using facts and feelings; provides relevant details</td>
<td>Describes an event, experience or artifact clearly using art education terms; provides relevant details,</td>
<td>Describes an event, experience or artifact with clear and precise art education terms; provides selective details and facts.</td>
</tr>
<tr>
<td>ANALYZE</td>
<td>Able to identify the strengths and weaknesses of an event, experience or artifact; connects artifact or experience to standards</td>
<td>Gives insights into decision making; demonstrates awareness of art education pedagogical issues; connects experience to prior knowledge, coursework and standards</td>
<td>Able to analyze an event, experience or artifact, analyzes artifact and/or experience with insight; connects coursework, field experience, theory, and standards.</td>
</tr>
<tr>
<td>SYNTHESIZE JUDGE</td>
<td>Able to clearly explain the quality of an experience, event, or artifact; gives insights and states reason for judgement</td>
<td>Able to state what learning has occurred as a result of producing artifact</td>
<td>Relates what was learned from artifact or experience to standards, theory, coursework and practice; indicates how artifact could be improved.</td>
</tr>
<tr>
<td>GOAL SETTING</td>
<td>Able to identify area(s) for future development and improvement</td>
<td>Uses peer and faculty input to plan future goals; able to plan both short and long term goals; able to identify objectives needed to meet goals; able to identify and articulate short term future goals; able to identify strategies needed to meet goals</td>
<td>Able to assess growth over time and state future goals for teaching or art.</td>
</tr>
</tbody>
</table>

Appendix N: Written Communication

Organisation, thought, language and expression

Level 3

- Demonstrates insightful and critical understanding and analysis of ideas and issues.
- Organises, shapes and develops material effectively and coherently for the required purpose.
- Uses language precisely and fluently, with effective command of vocabulary, syntax and other linguistic conventions.

Level 2

- Demonstrates sensible and reasoned understanding and analysis of major ideas and issues.
- Organises and develops material in a generally consistent and coherent manner for the required purpose.
- Uses clear expression that communicates with the reader, selecting vocabulary appropriately, and showing sound control of syntax and other linguistic conventions.

Level 1

- Demonstrates basic or incomplete understanding of major ideas and issues.
- Organises and develops material in a basic or partial manner for the required purpose.
- Uses language simplistically or unevenly, with a limited range of vocabulary and some evident faults of expression and linguistic conventions.

Source: Murdoch University (2003). Graduate attributes: communication skills.
Appendix O: A Teamwork Checklist

Give a mark from 0 to 5 for each element on the checklist.

<table>
<thead>
<tr>
<th>Poor</th>
<th>Fair</th>
<th>Average</th>
<th>Good</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Elements of Teamwork Checklist

1. COMMUNICATION
   - Excellent: Free, open expression of ideas and feelings at all appropriate times with no fear of embarrassment or reprisal
   - Poor: Stifled, close to the vest, guarded. Lets the other person start the communication

2. PARTICIPATION
   - Excellent: Full contribution, reaches out to lend a hand, readily available
   - Poor: Lack of initiative to help the other person? Not around when needed, begrudging contribution

3. GIVE AND TAKE
   - Excellent: Open to compromise, flexible? Recognition that it is sometimes better to give in than be "right"
   - Poor: Stubbornly dug in on own viewpoint, uncompromising, always right, never wrong

4. LEADERSHIP
   - Excellent: Promotes team actions and decisions, recognizes he/she needs the team, and lets each member know where they stand. Team members support his/her suggestions
   - Poor: No leadership initiated. Reacts rather than acts. Poor or reluctant support of ideas

5. ORGANIZATION
   - Excellent: Knows their responsibilities. Provides structure to accomplish team goals
   - Poor: Unclear of responsibilities or doesn't care about responsibilities

6. PREPARATION
   - Excellent: Did their homework. Research was thorough, especially as it affects other team members
   - Poor: Team progress was held up because of participant's lack of preparation. Consistently dropped the ball

7. PROCEDURE
   - Excellent: Lives by the ground rules and procedures. Functions smoothly, works with the team
   - Poor: Absence of order, operates on his/her own rules, progresses from crisis to crisis

8. CAPABILITY
   - Excellent: Members have confidence in participant and can rely on performance
   - Poor: Members do not show capability as a team

9. COMMITMENT
   - Excellent: Participant rallies to the goals. Goals clearly defined in his/her mind
   - Poor: Lack of awareness of, or resistance to, team goals

10. PROGRESS
    - Excellent: An attitude of action and momentum, makes suggestions of steps forward
    - Poor: Lack of initiative

Appendix P: Interpersonal Understandings

Analysis of work and general social situations

Level 3

- Demonstrates sophisticated insight into, and makes subtle inferences about, roles, relationships, behaviours, feelings, attitudes and motives.
- Demonstrates subtle insight into aspects of effective teamwork, leadership, negotiation and communication.
- Recognises potentially appropriate actions or responses to delicate or complex interpersonal problems.

Level 2

- Demonstrates significant insight into, and makes reasonable inferences about, roles, relationships, behaviours, feelings, attitudes and motives.
- Demonstrates significant insight into aspects of effective teamwork, leadership, negotiation and communication.
- Recognises potentially appropriate actions or responses to interpersonal problems that may not be familiar.

Level 1

- Demonstrates basic insight into, and makes reasonable inferences about, familiar roles, relationships, behaviours, feelings, attitudes and motives.
- Demonstrates basic insight into aspects of effective teamwork, leadership, negotiation and communication.
- Recognises potentially appropriate actions or responses to straightforward interpersonal problems.

Source: Murdoch University (2003). Graduate attributes: communication skills.
## Appendix Q: Research Overview

<table>
<thead>
<tr>
<th>Research Objectives</th>
<th>Research Questions</th>
<th>Procedures</th>
<th>Instruments</th>
<th>Data Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. To evaluate the process of learning: whether eportfolios improve interpersonal communication skills</td>
<td>To what extent does an eportfolio enhance students’ communication skills?</td>
<td>1. Students post the three reflection entries in their eportfolio</td>
<td>Document analysis: Entries in the eportfolio</td>
<td>Entries will be analysed using a written communication rubric developed by the Teaching and Learning Centre at Murdoch University (2004)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Learning Process Questionnaire distributed to students</td>
<td>Learning Process Questionnaire</td>
<td>Data from questionnaire will be analysed using frequency distributions and simple statistics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Focus group interview to elicit information about the impact of eportfolio on communication skills</td>
<td>Recorded interviews with focus group students</td>
<td>Interview responses will be transcribed and analysed, and narrative descriptions will use qualitative coding responses to categorize by identifying the patterns and summarizing in order to bring meaning to the text</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Interview with the instructor will be conducted</td>
<td>Recorded Interview with the instructor</td>
<td>Interview response will be transcribed and analysed, and narrative description will use qualitative coding responses to categorize by identifying the patterns and summarizing in order to bring meaning to the text</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Classroom observation by the researcher</td>
<td>A teamwork checklist (online:<a href="http://www.oncourseworkshop.com/Interdependence001.htm">http://www.oncourseworkshop.com/Interdependence001.htm</a>) and a interpersonal checklist (online:<a href="http://www.tlc.murdoch.edu.au/gradatt/graduatelevels.html">http://www.tlc.murdoch.edu.au/gradatt/graduatelevels.html</a>)</td>
<td>Observations will be analysed using the teamwork and interpersonal communication checklists</td>
</tr>
<tr>
<td>Step</td>
<td>Activity</td>
<td>Data Collection Method</td>
<td>Analysis Method</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>----------</td>
<td>------------------------</td>
<td>-----------------</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Learning Process Questionnaire distributed to students</td>
<td>Learning Process Questionnaire</td>
<td>Data from questionnaires will be analysed using frequency distributions and simple statistics</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Monitor the students’ discussion and comments in the eportfolio</td>
<td>Document analysis: Eportfolio comment</td>
<td>Data from eportfolio’s entries will be analysed using content analysis to look for patterns</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Focus group interview to elicit information about the impact of eportfolio on teamwork skills</td>
<td>Recorded interviews with focus group students</td>
<td>Interview responses will be transcribed and analysed, and narrative descriptions will use qualitative coding responses to categorize by identifying the patterns and summarizing in order to bring meaning to the text</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Interview with the instructor will be conducted</td>
<td>Recorded Interview with the instructor</td>
<td>Interview response will be transcribed and analysed, and narrative descriptions will use qualitative coding responses to categorize by identifying the patterns and summarizing in order to bring meaning to the text</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Classroom observation by the researcher</td>
<td>A teamwork checklist (online:<a href="http://www.oncourseworkshop.com/Interdependence001.htm">http://www.oncourseworkshop.com/Interdependence001.htm</a>) and an interpersonal checklist (online:<a href="http://www.tlc.murdoch.edu.au/gradatt/gsalevels.html">http://www.tlc.murdoch.edu.au/gradatt/gsalevels.html</a>)</td>
<td>Observations will be analysed using the teamwork and interpersonal communication checklists</td>
<td></td>
</tr>
<tr>
<td>3. To evaluate the impact on eportfolios on students’ reflection skills</td>
<td>To what extent does an eportfolio enhance students’ critical thinking and problem solving skills?</td>
<td>1. Students submit written reflective journal entries</td>
<td>Document analysis: Three reflection journal entries</td>
<td>Journal entries will be assessed using a reflection rubric taken from (Klein, Sheri, 2003) online: <a href="http://www.uwstout.edu/art/edportfolios/evaluating/presservreflex.html">http://www.uwstout.edu/art/edportfolios/evaluating/presservreflex.html</a></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>2. Learning Process Questionnaire distributed to students</td>
<td>Learning Process Questionnaire</td>
<td>Data from questionnaire will be analysed using frequency distributions and simple statistics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Focus group interview will be conducted</td>
<td>Recorded Interview with focus group students</td>
<td>Interview responses will be transcribed and analysed, and narrative descriptions will use qualitative coding responses to categorize by identifying the patterns and summarizing in order to bring meaning to the text</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Interview with the instructor will be conducted</td>
<td>Recorded Interview with the instructor</td>
<td>Interview response will be transcribed and analysed, and narrative descriptions will use qualitative coding responses to categorize by identifying the patterns and summarizing in order to bring meaning to the text</td>
<td></td>
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</tr>
</tbody>
</table>
Appendix R: A Refereed Conference Paper arising from the Research

The Engineering Eportfolio: Enhancing Communication, Critical Thinking and Problem Solving and Teamwork Skills?

Linda Mei Sui Khoo, Dorit Maor, and Renato Schibeci

Abstract—Graduate attributes have received increasing attention over recent years as universities incorporate these attributes into their curriculum. Graduates who have adequate technical knowledge only are not sufficiently equipped to compete effectively in the workplace, they also need non-disciplinary skills like graduate attributes. The purpose of this paper is to investigate the impact of an eportfolio in a technical communication course to enhance engineering students’ graduate attributes: namely, learning of communication, critical thinking and problem solving and teamwork skills. Two questionnaires were used to elicit information from the students: one on their preferred and the other on the actual learning process. In addition, student perceptions of the use of eportfolio as a learning tool were investigated. Preliminary findings showed that most of the students’ expectations have been met with their actual learning. This indicated that eportfolio has the potential as a tool to enhance students’ graduate attributes.

Keywords—Eportfolio, Communication Skills, Critical Thinking and Problem Solving Skills and Teamwork Skills

I. INTRODUCTION

Graduate attributes have received increasing attention in Malaysia [1], [2] and internationally including Australia [3], [4], [5], [6], the United States of America [7], [8] and the United Kingdom [9], [10]. The role of graduate attributes is highlighted particularly in higher education for over a decade [11], [12], [13]; these graduate attributes are important, too, for the government, employers, society, and curriculum developers [14].

Graduate attributes are the set of qualities and skills predetermined by a university that students should develop and acquire from the institution which later contribute to their career [15]; they are also known as soft skills in Malaysia [16]. These skills include communication skills, teamwork skills, critical and problem solving skills, ethical moral and professional skills, entrepreneurial skills, life-long learning and information management skills, and leadership skills [16].

Graduates who have adequate technical knowledge only are not sufficiently equipped to compete effectively in the workplace; they also need non-disciplinary skills, especially graduate attributes.

Engineering students develop technical knowledge in order to be certified as engineers but they also need additional, broader attributes in the workplace. These graduate attributes include oral and written communication skills, teamwork skills, critical and creative thinking skills and problem-solving methods [17]. Engineers need these attributes in order to fulfill the demands of employers.

According to Vijan [18], for example, graduates lack the skills of presentation and communication and therefore they were not able to impress employers during interviews. Malaysian universities also reported that they are not producing work-ready graduates because their education system is too exam-oriented [19], [20]. They produce graduates who are competent technically but lack graduate attributes. Another reason is related to the mismatch between what the universities are producing and what the Malaysian job-market seeks [21], [14], [22]. According to Sibit [23], graduates were unemployed not because they were not competent but rather because they lack graduate attributes that have been neglected in the educational system. This is because prior to 2006, graduate attributes were not incorporated into the university curriculum in Malaysia. A report by World Bank [24] claimed that there was a relationship between the workplace and university education. Findings from Tracer Study of Graduates [25] and commissioned research [26] stressed that tertiary education institutions should embed graduate attributes including language, team work, and problem solving into the curriculum. This is because these skills are considered to be the most critical skills in the recent global job market especially in a fast moving era of technology [16].

II. AIM

The broad context for this study is that all Malaysian public and private universities were asked to incorporate graduate attributes into their curriculum from August 2006 [16]. Assessing student achievement of the attributes is therefore important. One way to assess students’ achievement is by introducing eportfolio. Eportfolios can improve learning but the process of learning using eportfolios has not been thoroughly researched and so there is little evidence to support existing claims [27], [28]. Findings from previous studies do not reveal explicitly how the students’ learning benefited as a result of using the eportfolios. Therefore, this study fills a research gap by investigating the impact of embedding an eportfolio into a technical communication course. The study examined the learning process and used the students’ voice to
test the assertion that eportfolios might contribute to more effective learning in terms of communication skills, critical thinking and problem solving skills and teamwork skills. The research, conducted in one of the universities in Malaysia, gathered both qualitative and quantitative data to test this assertion. This paper focuses on the findings from learning process questionnaires. The research questions which guided the investigation are:

To what extent does an eportfolio enhance students’ graduate attributes; in particular:
(i) communication skills?
(ii) critical thinking and problem solving skills?
(iii) teamwork skills?

The structure of the questionnaires is provided below.

III. METHOD

The objective of the questionnaires was to find out if graduate attributes, particularly communication skills, teamwork skills and critical thinking and problem solving skills have been enhanced when they use the eportfolio as a learning tool in a technical communication course. These are three of the graduate attributes required by the Malaysian government of university graduates.

The study examined the learning process in developing an eportfolio by adapting the Plan-Do-Review cycle [29] as shown in Fig. 1. This cycle incorporates both the approaches of Kolb’s Experiential Learning Cycle [30] and Action Learning [31], as outlined in Pallister [29]. These two approaches are based on constructivist learning principles [32]. This cycle involves student-centred learning and the student has to become active, critical and reflective in his/her learning and to take responsibility for their learning. It fosters authentic learning when students are placed in the centre of the learning process and actively engaged in constructing eportfolios and gain the experience of the learning by planning, selecting, reflecting and sharing the artifacts [33].

The research instrument used for this survey is two forms of the questionnaire: preferred and actual learning process questionnaire [34]. The preferred form allowed students to give opinions about their ideal or desired learning in the classroom while the actual form assessed students’ actual experiences of the learning process and perceptions on the use of eportfolio in the classroom. The questionnaires were administered to the 66 students to find out their perceptions on the use of eportfolio and any effects on students’ interpersonal communication skills, reflection and collaboration and also about their perceptions on the use of eportfolio in the classroom environment. This questionnaire was adapted from Constructivist Multimedia Learning Environment Survey (CMLES) [34].

Fig. 1 The eportfolio process as a ‘Plan-Do-Review’ cycle (adapted from Pallister, 2007)

The questionnaires were distributed to the same students before and after their eportfolio experience. Surveys were administered in the second week of the semester and in the second last week of the semester, after students had completed all the assignments required for assessment. Each of the questionnaires took about 30 minutes to complete.

There were three sections in the questionnaire: I. Background Information; II. Interpersonal Communication, Reflection and Collaboration; III. Students’ perceptions about the use of eportfolio in Technical Communication Course.

Section I sought background information such as student gender.

Section II investigated three graduate attributes namely: Interpersonal Communication (Communication skill), Reflection (Critical thinking and problem solving skill) and Collaboration (Teamwork skill). There were five items in each scale. In the Interpersonal Communication Scale, questions asked students about interactions with their peers and work in the classroom. In the Reflection scale, students were asked about how they reflected while constructing the eportfolio. The last scale for this section is Collaboration where students were asked how they worked together in achieving their aims and improve their own learning. Students were also asked to write any additional comments they wished in the space provided after each scale.

In Section III, students’ further perceptions were sought about the use of eportfolio. The questions were constructed to investigate students’ perceptions of how they use eportfolio collaboratively in facilitating and generating learning. The scales in Section III were: Relevance, Ease of Use and Challenge, with five items in each scale. Each scale had a five-point Likert scale as follows: Almost never (1), Seldom (2), Sometimes (3), Often (4), Always (5). In the Relevance scale, questions were about the relevance of the eportfolio as a tool in facilitating the students’ learning. The Ease of Use scale
aimed to elicit responses about the convenience and usability of eportfolios as a tool in learning. The last scale in this section was about Challenge where students were asked whether the eportfolio could challenge them to enhance their learning. The students were also encouraged to write in any additional comments they wished to make after each scale.

Students were asked additional questions in the preferred questionnaire including: What do you hope to learn from using eportfolios in this Technical Communication course? The actual questionnaire included these two specific questions:

1. What have you learnt from using eportfolios in this Technical Communication course?
2. Do you have any negative experience(s) from using eportfolios in this Technical Communication course? If yes, please explain.

IV. RESULTS AND DISCUSSION

Section I of the questionnaire confirmed that the participants in the study comprised one class of 66 students, with 56 male and 10 female undergraduates. These students were second year engineering students who took a technical communication course as a requirement of their programme. They were aged 20 to 22 years old and mostly Malays and Chinese.

Section II findings are summarized in Fig. 2: the preferred and actual scale mean scores. The preliminary results suggest that students’ preferences were higher than they perceived actually happened in the classroom. The scale means for the preferred and actual forms indicate that students generally perceive a high level of Interpersonal Communication, Reflection and Collaboration. The results showed statistically significant differences for the three scales: they were, respectively, (t = 2.65, p = 0.01), (t = 4.57, p = 0.00) and (t = 2.84, p = 0.004). In spite of this, analysis of the student responses to the open questions suggested that most of the students’ expectations have been met with their actual learning. That is, the data from the open-ended questions supported the idea that there was no educational difference between student expectations (preferred form) to their experience (actual form).

In relation to the learning processes identified by the first three scales when using eportfolio in the course, there was a general perception among the students that they were Often engaged in Interpersonal Communication, Reflection and Collaboration and also the similar results obtained for the students’ preferences. This showed that while working on the individual eportfolio, students had the opportunity to engage in the learning process with their peers and facilitator.

The open-ended section of the questionnaire provided additional perspectives of students’ experiences with the eportfolio.

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The open-ended section of the questionnaire provided additional perspectives of students’ experiences with the eportfolio.

In the actual form, a student observed that his/her oral communication skill has improved when using eportfolio in the course.

"I can improve my English communication skill through this eportfolio. It has taught me that there is more to effective communication than just verbal and written communication. After all, I have come to realize the great importance of being a good and effective communicator in our daily lives." (S58)

Three students also claimed that they were able to explain their new ideas and interact with their friends. This enabled them to improve their eportfolio and have fun at the same time.

"I learn how to express my feelings, changing ideas with my friend and I got a chance to interact with them." (S10)

"I had learn many useful stuff in using this eportfolio. I can discussed with others student how to made my eportfolio better and better. Besides that we can discussed about our ideas to made it more fun." (S66)

"I have learnt how to improve my writing in English, share about cover letter and resume with friend also to improve and explain my ideas in eportfolio." (S42)

The students in general demonstrated that they had improved their interpersonal communication skills. They were able to explain their new ideas and interact with their friends, share their ideas and artifacts with their peers, give and get the feedback from their peers and this has resulted a positive outcome in their learning. They had also learnt how to post, edit and comment on their peers’ eportfolios and understood better of how to do the eportfolio and improved their eportfolio. Two students also expressed that the learning process has enabled them to foster relationship with their peers.
too.

"It can be used to describe people especially ourselves easily. It cause people to become closer to each other and it helped me to think that it is easier to have information and give information through internet." (S43)

"When asking friends to help about the blog can help to foster relationship and help us improve the communication skill." (S41)

The students suggested that their critical thinking and problem solving skills have improved when using eportfolio in the course. Two students believed that they had critically reflected on their own learning as they were able to generate new ideas in their learning. They also found that by viewing their peers’ blog and reflecting on them had allowed them to generate their ideas better. They claimed that the peers’ feedback had helped them better in the process of learning.

"Through eportfolio, we can learnt about how to generate idea, example in the blog, after gather information and view peer’s blog will generate new idea on blog. Then also can reflect about what’s the ‘things’ that we still needed to add for ourself in resume or eportfolio." (S62)

"I have learnt and practiced a process by using eportfolio in this course. We have learnt how to built in and generate a new idea at a high level to make up my blog." (S58)

The students reported that their teamwork skill has improved when using eportfolio in the course. For example, two students got to reflect on their own learning when browsing their peers’ eportfolio:

"In this class, usually me and my friend need to view others blog to read their reflection and sometimes, I can have new idea due to their blog. For me, an idea is very important because no idea means boring life." (S43)

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Many students said that they improved their learning when reading their peers’ eportfolio as they were able to generate new idea and improve the contents of their eportfolio. The students also mentioned that they were able to share their learning with their peers when they published their artifacts in the web. The students also added in the open-ended part of the questionnaire that they had reflected more effectively on their learning due to the feedback from their peers. They were able to exchange views on their work, learn their mistakes and get a better understanding on the tasks done.

"I learn how to upload artifact to blog and shows to others peer. From eportfolio, I get know what mistake I done when I finished done my artifact from my members comment. I get some information from the eportfolio how to do my artifacts." (S50)
"I learned some new things such as I can gather many useful information from other peer’s eportfolio, I can exercising my mind on generating ideas, I can provide and insert useful information, I can interact with other and discussing about our own eportfolio and in fact, I can also know some new things on how to use the eportfolio." (545)

Other students stated that the use of the eportfolio was not complex as the eportfolio was easy to post and respond entries:

"Eportfolios was easy to use. It helps me in presenting my resume, report and etc. My communications with teammates improved." (545)

"I have learned a lot of things from using this eportfolio. Even though this is my first time but it is not so hard for me to learn on how to use it. The most important things is I be able to give response to my work and get response from other." (519)

Most students also used the eportfolio to represent data in a variety of ways. For example, they learnt how to present ideas and publish their artifacts in the web. A paired t-test showed that the use of eportfolio did not elicit a statistically significant difference in actual-preferred Ense of Use scores (t = 0.1, p = 0.76). This shows that there was no difference in the score and thus, indicated that the use of the eportfolio had no impact on the Ense of Use. This was because the eportfolio was easy to use and navigate. Thus, they were easily comment on their peers’ work and received feedback from their peers. The students also mentioned that it was fun to use the eportfolio and discovered that the eportfolio allowed the tools like video, audio, and images to be included. They published their artifacts in the web and allowed sharing with their peers. Thus, this improved their own work. Students found it easy to use when they had learnt it:

"Even though the eportfolio is complex at first, the usage seems to be easy after I get used to eportfolio." (535)

"By using this eportfolios also, it makes things goes easier to me. More knowledge also had been gained by doing such at creating own blog." (514)

The students also noted that initially it was a challenge to use the eportfolio. Later, they found out that the eportfolio was easy to use when they had learnt how to use it. A paired t-test results showed that the use of eportfolio did elicit a statistically significant difference in actual-preferred Challenge scores (t = 3.48, p = 0.00). This shows that there was a difference in the score and thus, indicated that the use of the eportfolio had a positive impact on the Challenge. They said that there would be no boundary for them to expand or widen their creativity thinking in using the eportfolios. The eportfolio also polished their creativity skills. The eportfolio also helped students generate new ideas and artifacts. They felt the challenged and enjoyed using it in the class. Thus, the use of eportfolio had a positive impact on the students’ learning. Two students stated that the eportfolio was challenging to use in their learning. They elaborated that the eportfolio was challenging to use in their learning. They found that it needs time to explore and view others’ blogs in order to generate ideas. One suggested having a group blog rather than individual blog.

"The truth is, eportfolio is a great tool. But, it need a lot of experience and need to view others people blog constantly to generate and find out the new idea." (543)

"It is challenge when we know nothing before this because need to survey. In my opinion, encourage a group discussion to produce and design a high quality blog better than individual. Next time only produce individual if needed." (562)

On the other hand, some students had also encountered some minor disadvantage. One student was unsure of the function of the eportfolio and this had made him lose interest in the eportfolio.

"My big problem is lack of knowledge on how to use the function on eportfolio. So, I still confuse on the function of some application causing me to lose interest in it." (543)

A small group of students encountered some issues related to internet and computers. They did not have time to upload their blog because they did not have internet in their hostels, experienced low speed of internet connection in the lab and also experienced issues with the internet connection. Some complained that they were busy with their work and did not have time to update their eportfolio.

V. CONCLUSION

The study investigated whether the use of an eportfolio would enhance the following graduate attributes: communication skills, critical thinking and problem solving skills and teamwork skills. The eportfolio process Plan-Do-Review cycle was used as the framework for this research. In this paper, the data gathered from one aspect of the research, namely the two forms of the questionnaire are presented. The preliminary data analysis suggest that the use of eportfolio had a positive impact on the students’ learning. Further, the results of quantitative data were supported by responses to the open-ended questions. The findings of the study suggest that eportfolio has the potential as a tool to enhance students’ graduate attributes. In the longer term, this study may provide evidence which could contribute to higher education policy in Malaysia regarding the incorporation of graduate attributes.

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