

# **Towards the Realization of Engineering Postgraduate Students' Engagement and Employability: A PBL Involvement in ERP**

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## **Abstract**

Currently Project Based learning (PBL) is widely applied in higher education institutions. However, little is known about its critical influence as per postgraduate students' engagement, employability, tasks building and responses within the courses. This paper presents a case study which is built based on a qualitative mechanism to explore these focused issues gained by respondents in Master of Engineering Management course at Queensland university of Technology (QUT). To accomplish this, a questionnaire was prepared and designed comprising of two sections; the first part is about the demographical information of the respondents, while the second part includes five relevant questions about improvement of the master course and Enterprise resource planning unit administrated to 113 respondents. The qualitative analysis show that the dominant skills are management skills, communication skills, Software knowledge and related subject knowledge. Respondents show that the Enterprise Resource Planning (ERP) unit is organized well, lectures and tutorials are useful. Additionally, the BN87 course has an integrated comprehensive structure with all units implied. This paper may help lecturers and decision makers in their potential to redesign the relevant courses considering the views of the respondents and aligned with QUT long learning vision.

**Keywords:** Employability, skills, questionnaire, Project based learning, ERP

## **1. Introduction**

This paper presents the results of a questionnaire carried out to evaluate engineering postgraduate students' viewpoints regarding enterprise resource planning and project-based learning. Their perspective on the unit and the master program in addition to the potential acquired skills and competences also implied. Nowadays, numerous studies and methods are presented in order to be apply in engineering education, such as practicing project-based-learning and learning-by-doing, to achieve success in engineering courses and assimilate the engineer applicants into real life (Can, and Tora 2012),

The relevant skills found to be further enhanced are written/oral communication and teamwork skills. This is generally requested as it is important to communicate together, supposed to have significant effect and to build the theme of team work and encourage its adoption amongst students and learners. Enterprise resource planning unit is administrated by many engineering schools and faculties. This system comprises different applications and components which address that its implementation is not still easy and it requires an attention and follow up. This is the case similar to the engineering economy course which is delivered by many universities (Kapusuz and Can, 2014). Lehmann et al. (2008) introduced both problem and project-based learning as an innovative learning strategy for sustainable development in the engineering education. Jewpanich & Piriyaawong (2015) conducted a research aims to develop the project-based learning using discussion and lesson-learned methods via social media model (PBL-DLL SoMe Model) which is used for enhancing problem solving skills of undergraduate in education student. Woods (2013) described the learning environment while practicing the technologies of process oriented guided inquiry learning, model-eliciting activities, project-based synthesis. Karim(2010b) argued that the skills requested shall be focused and integrated with the industry needs and requirements. Chandrasekaran et al. (2012) explained that the benefits of

learning through projects include improved students' participation in the learning process (active learning and self-learning), enhanced communication skills, addressing of a wider set of learning styles, and advancement of critical and proactive thinking skill. Fernandes (2014) used PBL in higher education to improve students learning and prepare graduates for professional practice. PBL is defined as a teaching strategy that uses real-world learning activities to engage student interest and motivation (Charter, 2019). Furthermore, the research conducted by Cain and Cocco (2013) designate the value of PBL in growing student leadership through involvements in working as part of multidisciplinary teams requiring operative communication and managerial skills. Panagopoulou et al. (2006) utilized communication skills within their medical research such that the pilot project focused on enhancing students' communication skills, and integrate these with the research and clinical skills

The aim of this paper is trying to improve the content and design of the master of engineering management course at Queensland University of Technology (QUT) through introducing the project-based learning (PBL), engagement of postgraduate students and employability concepts aligned. These all are combined together through the unit entitled enterprise resource planning (ERP) which could be a vital unit to be considered as it has links with the industry. Though, postgraduate students during the semester lectures and delivered tutorials are provided with the several necessary skills that could assist them to be more qualified and more job oriented. To enhance their practical skills, groups of 3 or 4 students are worked together in team to develop the unit project based on the theories learned and understood through ERP. This way is trying to combine both PBL and Work Integrated Learning (WIL) through the curriculum. Besides, the concept of this case study comes from the fact that QUT is trying to implement its strategy which is built based on the real-world learning vision 2020 such that all students either undergraduate or postgraduate have at least to practice in some way the concept of WIL.

### **1.1 Problem identification**

ERP unit which is offered to postgraduate students at QUT is mostly related to introducing the planning systems for enterprises and the integrated departments and components. It is related to real life processes and operations; therefore, making the connection between theoretical parts and the practical aspects through its integration with the industry and labor market businesses. In order to make this unit more interesting, postgraduate students have to effectively engage and further collaboration is requested. Therefore, the unit project is included so that to bridge the existing gap in the literature between the theory and practice. Almost the concepts of ERP are theoretical in nature and there is a need to do some practical case studies to learn the system more effectively. This is the missing link and what this paper tries to focus on. The structure of this study is as follows; it starts with the introduction section showing the concept of PBL and problem identification. The second section focuses on introducing description of the elements considered in this case study such that the master course and the ERP unit. Methodology and designed instrument is introduced in the third section, while the analysis is reflected in the fourth section. Discussion, implications, limitations and future agenda are introduced in section five. References are in the last section.

## **2. Literature review**

### **2.1 Master of engineering management course description**

In this case study, we have applied the PBL strategy in a unit called Enterprise Resource Planning (ERP) and has a code (ENN570). This unit is delivered to postgraduate students among other units in the master of engineering management course (BN87), at school of science and engineering, QUT, Australia. ENN570 is unit focused on describing the main themes with about 120 students attending each year. The students in this unit have to design, build, test and conduct the unit project using the software such as MS ACCESS which is built and applied practically within industries in Australia in the form of the Work Integrated Learning (WIL) Mechanism. Generally, in this unit, the enrolled students must attend the lectures, tutorials and participate in the different relevant seminars or workshops. The learning outcomes of ENN570 are as follows; (1.) Identify the factors that lead to the development and implementation of ERP systems. (2.) Critically reflect upon theoretical approaches and analyse their application to achieve effective use of Enterprise Systems to support operations and management practices. (3) Justify and interpret theoretical propositions and related bodies of knowledge to critically evaluate the resolution of business problems and recommend actions in contemporary Enterprise Systems. (4) Describe how an integrated information system can support effective and efficient business processes. (5) Critically apply cross-disciplinary knowledge with creativity in decision making supporting the development, implementation and use of Enterprise Systems. (6.) Plan and execute a substantial evidence-based project linked to Enterprise Resource Planning Systems to generate and evaluate complex ideas and concepts at abstract and practical levels. The proposed PBL that conducted by postgraduate students is expected to realize 2, 3, 4 and 6 of the unit learning outcomes (Karim et al.2019).

### **2.2 Research project within ENN570**

To bridge the existing gap between the theory and the practical sides, QUT adopts Work Integrated Learning (WIL) concept so that students can capture the knowledge and themes introduced in the unit; Since ENN570 aims to assist students to refine their communication and group work skills, and assist in development of research-based skills, it is considered a core unit. Though, among the assessment types of this unit there is a unit research project, which is compulsory for all students enrolled in the ERP unit. The structure of this research project is concerned that groups and not individual students are participated in applying some concepts of ERP learned in the lecturers, tutorials and sharing these knowledges in the practical side by focusing in one industry. The designed projects are prepared based on the system built considering the Microsoft access software. The group consists of either 3, 4 or 5 students are working together towards achieving the desired objective. Some of the projects introduced by the postgraduate students are developing ERP for printing shop, ERP for food company, ERP for paper manufacturing industry, ERP for medical college and hospital.

## 2.3 Theoretical framework

The theoretical framework in this paper is adapted and consistent with the study conducted by Chang and Lee (2010) as they considered some of the useful skills such as technology skills, research skills, projects assignment in the first phase, and secondly assign projects in the subsequent phase. Fox (2013) questioned: *“Does project-based learning increase content knowledge and motivation among learners?”* Considering that practice teamwork, presentation skills and time management skills are among the concepts to reinforce PBL and subject content knowledge learned.

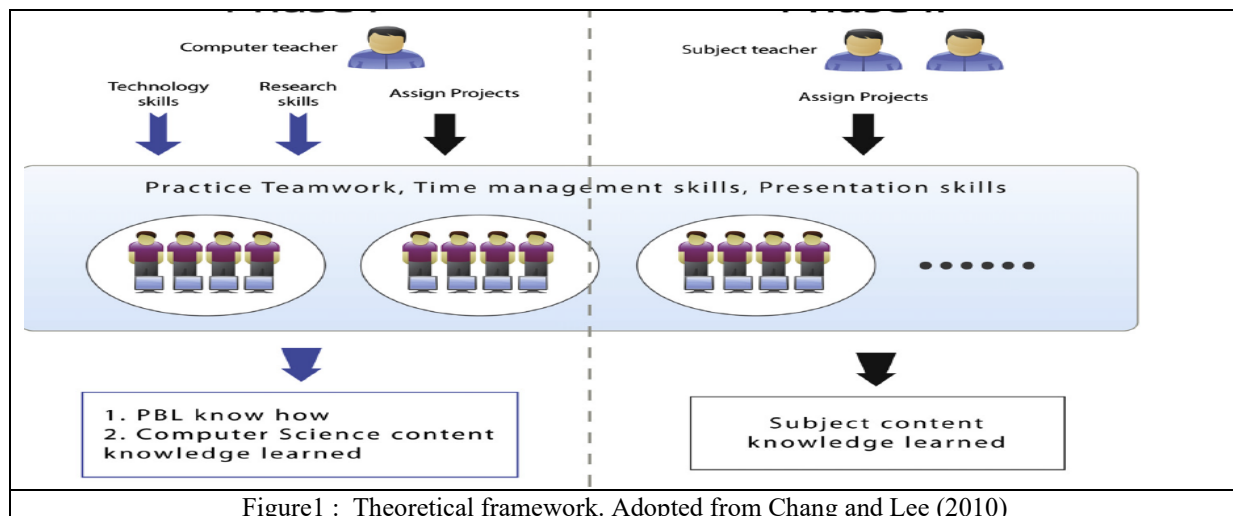


Figure1 : Theoretical framework. Adopted from Chang and Lee (2010)

It is hypothesized that PBL may have a positive attitude and linkages with the content knowledge, which enhance motivation between, key learners.

## 3. Methodology

### 3.1 Sample and data

Respondents in this paper are considered the postgraduate students in the master of engineering management course who studied the unit entitled enterprise resource planning and conducted the unit practical project. These are considered for two consecutive academic years as 2019/2020 and 2019/2018. Though, 113 students are considered and answered the questions based on the designed questionnaire. The developed questionnaire is distributed to the students during the lecture and they responded and submitted the answers at the end of the lecture. So, the response rate is considered acceptable as all students returned the filled questionnaire. This approach is similar to a study conducted by Karim(2010b).

### 3.2 Instrument used

Instrument used in order to achieve the main objective of this study and found an appropriate methodology is by adopting the questionnaire format, which is designed considering the focal issues that can be reviewed and answered

by the respondents. Though, the designed questionnaire comprises two main sections. The first section is regarding gathering the basic demographical information for the respondents in QUT, Australia. The second section of the designed questionnaire consists of five (5) questions are designed with other experts in the field to explore the employability of the students and their engagement within including enterprise resource planning unit and Project based learning manner. These questions which are open question style are established as follows. The same questions are administrated to all respondents seeking their inputs.

<b>Table1: Questionnaire design</b>		
<i>Layout of section 1</i>		
	<b>Question</b>	<b>Question design</b>
1	Gender	<b>Closed answer.</b> Two alternatives are given to respondents and must select the appropriate answer from these allowed alternatives. The answer could be either male or female.
2	Major of Bachelor degree study	<b>Open answer;</b> student here can answer based on his/her specialization or study programme field in the Bachelor stage.
3	Length of study at QUT	<b>Open answer:</b> how many years or months for the study or stay in QUT till the period of questionnaire distribution.
4	Current GPA	<b>Closed answer.</b> Six alternatives are given to respondents and must select the appropriate answer from these allowed alternatives regarding the current GPA.
5	Age	<b>Open answer format.</b>
6	Country of origin	<b>Open answer format.</b>
<i>Layout of section 2</i>		
	<b>Question</b>	<b>Question design</b>
1	What is your career plan after graduation?	<b>Open answer</b>
2	What are the main skills you think will be necessary to pursue this career path (please try to be as much specific as possible?)	<b>Open answer</b>
3	How many you thing you have attained these skills so far?	<b>Closed answer.</b> Four alternatives are given to respondents and must select the appropriate answer from these allowed alternatives.
4	What are the positive things done in ENN570? Any comments about ENN570?	<b>Open answer.</b>
5	Your comments about master of engineering (BN87) course (positive experience, suggestion for future improvement)?	<b>Open answer.</b>

### 3.3 Instrument validity

The questions included in the questionnaire developed by authors are considered general in their nature. This means that validity can be realized as discussion is conducted with the experts from teaching and learning unit, industry experts, experts in other universities, personal research, senior academics.

## 4. Results

This section implies analysis of the administrated questions through the designed questionnaire distributed to postgraduate students. Here, the two main sections are considered for the analysis.

### 4.1 Section one analysis: demographical analysis

*The first question in this section* is regarding the gender of the respondents. They are requested to determine their gender appropriately. Analysis shows that most of the respondents are male students with a percentage of 77.87 % (frequency of 88) postgraduate students out of 113 total respondents. On the other hand, only 22.13 % are female

students. This means that majority of students enrolled in the master of engineering management course are male students and that they are more involved in completing higher studies to further enhance their learning process and through increase their employability rate to get good career. Table 2 displays the analysis.

<b>Table 2: classification of participants</b>		
<b>Gender</b>	<b>Frequency</b>	<b>Percentage</b>
Male	88	77.87 %
Female	25	22.13 %
Total	113	100 %

*The second question in this section* is regarding the main specialization and programme of study during the bachelor degree. Analysis as it reflected in Table 3 revealed that respondents are grouped within several specializations considered while studying their first degree (i.e., Bachelor). However, most of them focused on studying and learning the mechanical engineering with frequency of 40 out of 113 (35.4 %), followed by civil engineering bachelor with frequency 16 out of 113 (14.1%), electrical and electronics engineering comes in the third rank with frequency 15 out of 113 (13.3%). Besides, engineering management is also among the interests of the respondents (i.e., 9 respondents are enrolled) which shows the importance given by key respondents to the management discipline and their linkage and collaboration with the engineering science.

<b>Table3: classification based on the specialization</b>		
<b>Specialization (B.Sc)</b>	<b>Frequency</b>	<b>Percentage</b>
Civil Engineering	16	14.1 %
Automobile engineering	1	
Mechatronics engineering	4	
Biomedical engineering	3	
Mechanical engineering	40	35.4 %
Aerospace Engineering	1	
Electronics and communication	8	
Electrical and electronic engineering	15	13.3 %
Industrial engineering	4	
Professional Engineering (mechanical +management)	3	
Engineering management	9	
Thermal energy and power engineering	1	
Project management	2	
Optical engineering	1	
Instrumentation and control	1	
Production engineering	1	
Chemical engineering	1	
Materials engineering	1	
International business administration	1	
Total	113	

*The third question in this section* is about estimating the length of study at QUT. Each student separately estimates the period he/she stays till now as per the progress in the different academic semesters. As per the different postgraduate students, the estimate about the length of study period can be reflected in the following Table 4

<b>Table 4: length of study and frequency</b>	
<b>Length of study period</b>	<b>Frequency</b>
Less than 1 year	25
1 year	13
1 year and 6 months	7
2 years	49

2 years and 6 months	1
3 years	3
3 years and 6 months	0
4 years	1
5 years	2
8 years	1
Not determined	11

Analysis shows that around 49 postgraduate students enrolled in the master course are staying in the past 2 years in QUT doing their higher studies. This is acceptable duration for master student to stay in the university to practice the learning process including the technologies as possible as these students are expected to work in their current careers before coming to the lectures. Additionally, while other 25 students are staying less than one year in QUT, this means that they are new students enrolled. Maybe they are either part time or full-time bases. Besides, this is followed by other 13 postgraduates' students who stayed in the last one year in QUT. 11 students did not determine how many years they are stayed in QUT, but, however, any inputs are used and data are considered critically.

**The fourth question in this section** is about determining the current Grade Point Average (GPA) for each student. The answer for this question depends on the progress and achievement of each student separately. Though, six alternatives are considered for possible considerations. Analysis based on the respondents' feedback are displayed in Table 5. The highest rank of the estimated GPA is within the range of (6-7) such that 42 students are considered in this range as high distinction. These have 37.17 % percentage. This is followed by the second range of (5-6) such that 41 students are within this range. This reflects that most of the students are working hard to get higher marks and trying to upgrade their developmental skills and knowledge which can finally affect their employability and facilitate it. Some postgraduate students 12.38 % did not answer this question and did not provide any useful data regarding their current GPA and this is referred to that maybe they are new students in the master course and do not like to share this with others.

<b>Table 5: GPA ranking</b>			
<b>Current GPA</b>	<b>Frequency</b>	<b>Percentage</b>	<b>Rank</b>
6-7	42	37.168 %	1
5-6	41	36.28 %	2
4-5	8	7.07 %	4
3-4	0	0	5
Below 3	0	0	5
Other	8	7.07 %	4
Not determined	14	12.38 %	3

**The fifth question in this section** is about the estimating the postgraduate student age. It is an opened question so that student can determine the exact age in years. Analysis is reflected in Table 6

<b>Table 6: postgraduate current age and frequency</b>	
<b>Current age</b>	<b>Frequency</b>
21 years	1
22	7
23	19
24	13
25	14
26	12
27	8
28	6
29	2
30	1
31	2
33	1
35	1
36	1

37	2
39	1
not mentioned	22

The above Table 6 shows that among the postgraduate respondents 22 students did not mention their age in the answer sheet, where as 19 students are within the age of 23 years, which indicates that most of the students enrolled in the master program are within the young people and their readiness to enroll in higher education studies are high.

**The sixth question in this section** is regarding deciding the country of origin for each separately. Analysis depicted in Table 7 shows that the highest number of the postgraduate students originally coming from India with a frequency of 64 out of 113 (percentage of 56.6 %). Besides, 9.73 % are originally from China. Other students enrolled in the master program of engineering management are distributed within other countries including middle east (Saudi Arabia, Egypt), South east Asia and Europe. Two students are originally locally from Australia. Results here show that the international students are greatly enrolled in the master course and they are interested to complete their higher degrees in QUT.

<b>Table 7:country of origin</b>	
<b>Country of origin</b>	<b>Frequency</b>
India	64
china	11
Denmark	2
Sri lanka	4
Peru	1
Saudi Arabia	2
Australia	2
Oman	1
Pakistan	5
Brazil	2
Taiwan	4
South Korea	1
Malaysia	4
ZIMBABWE	1
Germany	3
Venezuela	1
Egypt	1
Indonesia	1
Colombia	1
Philippines	1
Thailand	1

## 4.2 Section two analysis

There are five questions in this section as per the developed questionnaire.

### 4.2.1 Question 1 analysis:

This question is focused on deciding about the career plan and possibility after graduation from the university. Responses are grouped as follows in Table 8. There are several alternatives regarding the career path expected after getting graduated from QUT. However, amongst the alternatives assigned by the respondents, the highest frequency is dedicated for the position to be as professional engineer, operational engineer, or an engineering manager. This has 34 frequency rated. Then, it is followed by the desire to have a good relevant career either in Australia or outside the country (frequency of 30). The potential as project management or project manager field comes in the third priority amongst the respondents with a frequency of 22. These are the most preferred and considered for the students while their willingness to have a suitable job.

<b>Table 8: responses categories</b>	
<b>Response category</b>	<b>Frequency</b>
Try to find a good job in relevant field, Australia	30

To be tutor	2
Work at managerial level at the technical firm	2
Become a successful business member and <b>operational engineer</b> ( engineering manager)	34
Become a project manager (project management) at construction company	22
Temporary traffic management	1
Consultation work	2
Work in sales and marketing environment	1
Corporate management	1
PhD in relevant field of study or to find job	5
Work in Asset management	1
Start own business/ private business	3
Complete for master of engineering	1

#### 4.2.2 Question 2 analysis:

The second question is directed to respondents to check their interested skills to fulfil the career path they are expected to join. Table 9 summarizes these selected skills by respondents. Table XXXX shows that there are different interested skills which can be adopted by respondents to pursue their career path. These are concerned with managerial skills and issues, technical skills, customers focus and interrelationships, behavior and others. The diversity here is expected as the students are from different specializations fields, and have different knowledge and priorities. Hence, analysis discovers the existence of 63 skills as it reported. However, the most relevant skills are management skills, communication skills, Software knowledge & related subject knowledge. These have the highest frequency of (28) together. Though, these are amongst the top priorities for the respondents. These skills are followed by team work skills (have frequency of 17), then, leadership (have frequency of 14), project management skills (frequency of 11).

<i>Table 9: major response categories</i>			
<i>Response category</i>	<i>#</i>	<i>Response category</i>	<i>#</i>
Management skills & leadership	28	Personal interest and independent work	2
Time management	10	flexibility	1
Technical skills	10	Dedication	1
Communication skills	28	Project management	11
Software knowledge & related subject knowledge	28	Research presentation and skills	5
Simulation and analysis, Matlab	5	Microsoft project	1
Spreadsheets and Microsoft office	11	Good knowledge in production	4
Product design software & electrical design	10	ERP & TQM adoption and implementation	8
Sovo works	1	Work experience	4
Engineering skills	9	Management tools and data management	3
Professional attributes	2	Cost management	1
proactive	1	Smart	1
Networking	3	Leadership	14
Team work	17	Presentation skills	7
Analysis skills and abilities	5	Implementation of subject in industry and experience	4
Good attitude	1	Acquired skills	1
Language frequency & english	2	Marketing skills	2
Customer relationships	3	Quick learner	2
brainstorming	1	confidence	5
Understanding of systems	3	People management	2
Writing skills	3	Adapt to changes	1
Work under pressure	3	Critical thinking	2
organizing	2	Revit	2
Planning	1	Self-awareness	1
Problem solving	5	logical	1



Taking risk	1	Better GPA	3
Patient	1	Process operations	1
Investment	1	Decision making	2
diligence	1	Facility management	1
Motivation to learn new things	2	Self-esteem	1
Having the right contact	1	Asset management	1
Attention to details	1		

#### 4.2.3 Question 3 analysis:

The third question is regarding the percentage of how many the graduated student attained the skills required. The answer here is expected to be amongst four indicated percentage rates including either 75-100 %, 50- 75%, 25-50%, and below 25%. Answers for responses reviews are as it displayed in Table 10. Analysis shows that 57 respondents are classified among the period within the range of 50-75% that attained the desirable skills, which is the highest rank. This can be interpreted that respondents are aware of the skills they adopt and think that these skills are more related to their work and can promote the critical thinking, enhance the collaboration within the team members and can enrich their knowledge of the different subjects. This is followed by 32 respondents classified amongst the top rank (75 -100 %) achieved the desirable skills as requested.

<b>Table 10: Respondents and frequency</b>	
<i><b>Respondents</b></i>	<i><b>Frequency</b></i>
75-100 %	32
50-75%	57
25-50%	14
Below 25%	2

#### 4.2.4 Question 4 analysis:

The fourth question is about mentioning any suitable comments regarding ENN570 (project) such that if there is a positive issue focused on these issues. It is an opened question designed so that respondents can comment clearly about their opinions and suggestions. Analysis as it reflected in Table 11 shows numerous comments and suggestions that are concerned with the unit and the unit research project administrated and practiced by the students in the academic semester. Among the proposed suggestions raised by the respondents are giving more and extra time for completion the exams of the units. This can be achieved through concentrating more on the time for each question, and the reviews from the lecturers and instructors to match number of questions in the exam with the time allocated for each question. By this, students can try to answer the simple questions first, not wasting their time, and finally to answer the difficulty questions if any. Other suggestion which can be applied also is providing further training courses on the proposed software for building and designing the ERP system. This can ensure that postgraduate students can further understand clearly what are they doing, the boundaries of the system and the general picture about the system components and concepts aligned. One student suggested to use other software rather than Microsoft Access to handle the ERP system. More quizzes, and exams are suggested so that students can ensure to get better GPA than before. The highest frequency (31 out of 113) as it displayed here is allocated for the lecturers, class notes, tutorials as these found to be interesting and useful materials. Furthermore, the knowledge on the subject matters such as focusing on forecasting, production planning, JIT, inventory management and scheduling are within the core of ERP to be practiced more successfully.

<b>Table 11: responses and frequency</b>			
<i><b>Response category</b></i>	<i><b>Frequency</b></i>	<i><b>Response category</b></i>	<i><b>Frequency</b></i>
More interesting class, lecturers, tutorial and perfect	31	SAP introduction	1
Learn more about ERP and application in better organized manner	15	Working schedule	1

Understand the importance, structure and knowledge of ERP module	20	Further training is requested on the Access software to generate ERP system (suggestion)	9
Good theoretical knowledge of resource planning, scheduling, production management, forecasting, inventory management (ERP)	26	Knowledgeable and proactive	2
Learning Microsoft Access programming, use and importance.	23	Enough time is requested for exams completion (suggestion)	4
Other software's can be used instead (suggestion)	1	Group working and discussion	9
To design an ERP system	9	Technical programming skills	2
Presenting ERP knowledge in good presentation	10	Project delivered in the unit helped to develop ERP skills taught.	3
Overall good experience and helpful subject	8	Explain more about the overall structure of presentation during the lectures	1
Practical and Industry cases more exposure	10	Provide more cases, and tasks to help students analyze ERP system(suggestion)	6
Understand different ways of thinking while working in groups	1	More quizzes are requested, and mid-term exams marking are sorted clearly. (suggestion)	2
Start project and database establishment as early as possible	1	The connection between the different departments	2
In class problem solving	11	Understand business nature of the different organizations	3
Increase speed of tutorials for efficient problem solving	2	Provide session for students for searching jobs (suggestion)	11
Booklet provided is very useful	1	To not form groups within the first weeks of the semester as students may do not know each other's.(suggestion)	1
Staff members are actively trying to assist	1	Assignments are good	3
Project based learning	1	Good to learn real life problems and solutions	4
Classes are too long	1		

#### 4.2.5 Question 5 analysis:

This question is an open answer designed to review the general comments about master of engineering management (BN87) course (positive experiences) and any suggestions for future improvements. Analysis in Table 12 shows that 19 respondents agree that the course is organized well and prepared to be integrated with the different units. Besides, 12 postgraduate students indicates that the course provided them with a positive experience and knowledge. Moreover, 11 responses also introduced that they learnt a lot from knowledge acquired and technologies in the course included. Other 11 responses clarified that there is a need for more real case studies and practical projects with the relevant institutions such as industries so that to enhance the practical skills on Enterprise resource planning unit. The responses in this question are vary as it is expected since respondents' students are come from different specializations and this master course is general for all whom can learn more from the units and the practices aligned within the course structure.

Table 12: responses categories			
<i>Response category</i>	<i>Frequency</i>	<i>Response category</i>	<i>Frequency</i>

More real case studies and presentations are requested including the industrial visits and collaboration with real time projects.	11	Learned much knowledge and technologies about management in engineering sectors and higher educational level.	11
It is positive experience and friendly environment	12	It could help with project, by combining with a company.	1
Multi industry tasks	1	Don't know about my future in this field in the job market	1
Master of engineering course structure is nicely arranged with all necessary units (good)	19	Understand and increase the ideas about management role in organizations	2
Mixed views as some units are useful such as (PMP, Asset mgmt....)	1	It is better to distribute the lessons/workload more as the last three weeks is very hectic (4 presentations & 5 assignments).	4
The structure of the course needs improvement	4	For the international students; to complete four subjects in the semester is more pressure on them.	1
Data analysis and optimization subject needs more time to understand concept.	1	Assignments of the different units should have gaps	1
Don't like group work especially the irresponsible team members	1	Maybe a unit about leadership of people could be helpful	

## 5. Discussion, conclusion and implications

This paper is a case study about project-based learning implementation in a specialized enterprise resource planning unit (ENN570) conducted with the postgraduate students of master of engineering management (BN87) course. It contributes to the project-based learning area as it reflected in the postgraduate students' enrollment and participation in the unit project concerned with ENN570 ERP. Here, this study explores the followings (1) what are the relevant skills for engineering students that can be enhanced to further pursue the career path? (2) What are the improvements/suggestions can be done on BN87 and the relevant positive experiences. To answer these questions, authors developed the questionnaire including two sections. It is recognized that redevelopment of the course can foster and enhance teaching and learning as it adopts the interactive and deep learning by students which can affect their academic achievements and performance. The qualitative analysis based on the introduced themes show that the master course is well prepared and organized in better manner, however, still some suggestion and recommendations are raised by the respondents towards improving the unit and the course at all. Focusing on the real learning is among the priorities in QUT. This encourages staff members and students together to be engaged in the learning and teaching process and focusing on the new techniques for curriculum redesign that matches with the international standards and intended learning outcomes. The implications of this paper come as a result of introducing the research project to the students and trying to upgrade their practical skills and knowledge in relevant field. These projects are based on real life problems and adopting the technologies to find an appropriate technique for solving the potential problems. A real implication here is considering this case study conducted in the developed nation of Australia and within one of the top ranked university, QUT. The designed questionnaire has a clear impact as it is directed to postgraduate engineering students from different countries and this could be treated as one of the advantages for this study. This means that views, criticism and suggestions for improvement are treated from several key persons specialized in the different engineering sciences and practices.

### 5.1 Limitations and future research

Similar to other studies in the field, this paper has limitations such that this study is qualitative designed. Further, it is conducted focusing on only one university and one unit and course designed. Other researchers can utilize the developed questionnaire and adopt to other units/courses so that improvement and redevelopment can be established. Future research can be established while doing empirical investigation on the assessment processes aligned for the unit introduced.

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