Investigating the Gap Between University and Host Company in Students Performance Assessment and Evaluation for Industrial Training Programme: A Case Study

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Abstract* — Most academic institutions agree that industrial training can provide an effective practical experience and exposure for students as well as closing the gap between learned theory and practical reality. One of the challenges of implementing industrial training is on bridging the different level of the outcome expectation between the academic and the industry. The objective of this study is to determine the level of the assessment from both the host company and the faculty supervisors/university as well as the significant difference of the results obtained by looking at the correlation of the assessment results between the two parties as method of indication. The research approach adopted is qualitative in nature with data acquired using questionnaires of the two assessors (faculty and industrial supervisor) for 322 engineering students from Universiti Teknikal Malaysia Melaka in 2013. Mean, standard deviation and t-test analysis were carried out in order to test the null hypotheses, which is, for each of the six assessment criteria, there is no significant difference between industrial supervisor evaluation and faculty supervisor evaluation. The results shows that, except for the technical knowledge criteria, there exist a significant difference between industrial supervisor evaluation and faculty supervisor evaluation; which could lead into a conclusion that it is an indication that there exist expectation, perception and alignment gap between the two assessors and need to be urgently addressed by the institution. One recommendation proposed to address this issue is to have a micro level learning contract between the university and industry.

Keywords- industrial training, internship, practical training, outcome based education, assessment rubrics

I. INTRODUCTION

Industrial Training (also known as practical training or internship) is a three-way partnership education program (university, students, and industry) which aims to provide practical experience and exposure for students and to close the gap between learned theory and practical reality. The Government and employers alike; are expecting universities to provide work ready graduates who have the necessary professional skills to transit seamlessly into the workplace; which can be accomplished via this program. According to [1], internship courses provide learning opportunities for undergraduates to experience professional practice and activities associated with knowledge application. In Malaysia engineering curriculum, according to Engineering Accreditation Council (EAC), industrial training program is integrated as part of the academic curriculum and the students shall undergo a minimum of 8 weeks and shall be adequately structured, supervised and assessed.

Government expectations (objective and outcome) for the industrial training are to develop, implement and be in line with the national agenda, such as the Government Transformation Programme, Wawasan 2020 etc, specifically in enhancing the employment and employability skills of the graduates. Furthermore, in 2010, the Malaysia Institute of Higher Learning has also developed it's own industrial training policy booklet to be used as base guideline for the industrial training objectives, expectations, planning and implementation across all universities and industries in Malaysia[2]. This expectation is then cascaded down into learning objectives or outcomes and thus the assessments to measure the achievement, in accordance to the Outcome Based Education (OBE) principle. It is also important for the host company (as well as the university via appointed faculty supervisors) to supervise and provide formal feedback and assessment as students need to know how they are progressing if they are to learn from their experiences; apart from just calculating marks and grades [5],[6]. This is also in line with the concept of Constructive Alignment, established by Biggs 1995, saying that the outcome, delivery and the assessments of any academic courses should be aligned in order to ensure effective teaching and learning.

However, according to [3], although the expectation should ideally be the same, there is a high potential that these expectations and understandings might not properly aligned, which causes different "versions" of interpretations of the objectives, outcomes and the assessments instruments (or rubrics) used to evaluate the student. Even worse, this also could lead to conflict of interest, in which can have adverse impact on the student's performance evaluations. Therefore, this paper shall attempt to investigate this gap in expectations between the two stakeholders from the perspective of the industrial training assessment and evaluations by using a case study at Universiti Teknikal Malaysia Melaka. The next few sections will discuss the research framework, literature review on related topics of significant , the methodology, and finally the results and conclusions of this study.

II. THE INDUSTRIAL TRAINING PROGRAM – RESEARCH FRAMEWORK

Bachelor of Electrical Engineering (of Faculty of Electrical Engineering, Universiti Teknikal Malaysia Melaka) is a 4-year degree program and consists of 3 different concentrations, namely Industrial Power, Power Electronics and Drive, as well as Control , Instrumentation and Automation. Apart from that, Bachelor of Mechatronics is also offered to the students as part of the Faculty's programme. In all of these programmes, it is mandatory for the students to undergo a 10 weeks of industrial training program (to obtain 5 credits, with pass/fail grade) at a host company, during their semester break (between semester 6 and 7) of the total 8 semesters. The University has established that, the objectives of this program are as follows:

- To fulfill the curriculum requirements for students graduation as required by the Engineering Accreditation Council (EAC) or Board of Engineers Malaysia (BEM).
- To enhance the knowledge, skills and experience of the students.
- To give an opportunity to students to apply knowledge gained at the University.
- To improve employment and employability of the students upon graduation
- To give an opportunity to industrial organizations to jointly involve in forming students, who are educated and trained in the University.
- To enlighten the students to appreciate and be prepared on the challenge of real working environments at working sites, as well as, recent technological needs and advancement before they graduated.
- To enhance soft skills of the students, primarily in enhancing creativity and innovative capabilities of the students.

Referring to EAC Manual 2012, each engineering programme must establish the following; Learning outcomes (LO), Program Outcomes (PO) and a matrix linking courses to PO, in which must be aligned to the University's vision, mission and objective. All educational programs (or subjects) shall have its own LO which is also need to be aligned to the Programme Outcome (PO). LO can be defined as statements that contain what a student is expected to be able to achieve as a result of a learning activity. Listed below are the LO for the industrial training program.

1. Able to communicate (oral, written and response affectively by delivering ideas and contents clearly).
2. Able to demonstrate technical knowledge.
3. Able to identify and analysis problem, proposes creative solutions and choses appropriate strategies to solve the problem.
4. Able to work effectively in a group by understanding and performing the role as a team member.
5. Able to apply good professional and ethical practices performed in the company.
6. Able to search, manage and synthesize information.

Meanwhile POs are referring to statements that describe what students are expected to know and able to perform or attain by the time of graduation. These statements are related to the knowledge, skills and abilities that students should possess through the program. In order to achieve all of these LO, the assessment done are based on observation on the student's performance by both the university (represented by the faculty members) and the industry (represented by the industry supervisor). The method of assessment set by the program is via observation, student's report and logbook on activity done in the industry during 10 weeks training. Table 1 shows the matrix of the LO for the industrial program versus the established PO for the engineering programme and Figure 1 shows the overall research framework of this study.

Table 1: Learning Outcome versus Programme Outcome matrix for industrial training of FKE, UTeM.

LO / PO	Engineering knowledge	Problem Analysis	Design/ development of solutions	Investigation	Modern tool usage	Engineer and society	Environment and sustainability	Ethics	Communications	Individual and team work	Life-long learning	Entrepreneurship
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
LO 1									√			
LO 2	√											
LO 3		√										
LO 4										√		
LO 5								√				
LO 6											√	

The assessment of the program uses established rubrics which address all the six learning outcomes. The assessment marks are divided into 50/50 contributions from both the faculty and the industry supervisors and both shall assess the same LO. The assessment method is via personal observation (e.g. behaviour, knowledge attainment etc), logbook content and the final report. The LO assessments are using a rubric-based questionnaire, with using similar performance criteria questions.

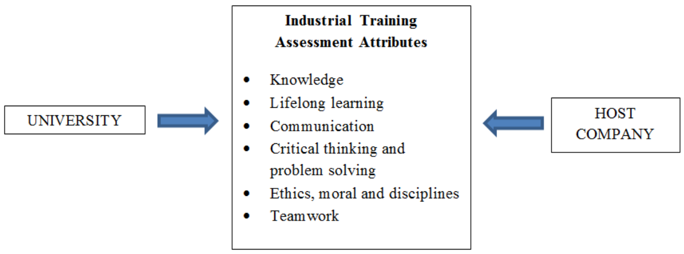

Figure 1: Research Framework

III. THE INDUSTRIAL TRAINING ASSESSMENT GAP FROM RUBRICS PERSPECTIVE

As discussed in the previous section, the industrial training LO assessment are carried out by both academic and industry supervisors by using a rubric-based questionnaires.

In general, rubric is a scoring tool for qualitative rating of authentic or complex student work which contains specific criteria for rating important dimensions of performance, as well as standards of attainment for those criteria. The rubric tells both assessors and students what is considered important and what to look for when assessing [4]. One widely cited effect of rubric use is the increased consistency of judgment when assessing performance and authentic tasks across students, assignments, as well as between different assessors.

Some studies have been conducted on the importance of considering on testing the quality of a rubric by determining if it measures what it is intended to measure (validity) and provides for consistency in scoring (reliability) [5], [6] . Some case studies have shown that, when having two or more assessors, the use of rubrics can lead to a relatively common interpretation of student performance. [7].

However, many evidence of disagreement were reported between assessors (reliability issue) using rubric-referenced marking schemes where considerable variation across different assessors in terms of consensus[8]. Results from studies investigating intra-rater (different assessors) reliability indicate that rubrics seem to aid raters in achieving high internal consistency when scoring performance tasks. The same author also summarizes that as a rubric can be seen as a regulatory device for scoring, it seems safe to say that scoring with a rubric is probably more reliable than scoring without one. On another dimension, the validity of the rubric is also important since it answers the question whether the assessment measure what it was intended to measure. One study in [9] indicated that validity issues in rubrics could mean that there might be no alignment between objectives and assessment, or that there are severe social consequences or bias causing different interpretation, understanding and expectation of the assessors on the rubrics used; even though all assessors are provided with the same assessment rubrics and measuring the same student. All these factors that reduces validity might produce unfair results, in the sense that students are disadvantaged in their opportunity to show what they have learned. [4].

In [3], the authors have presented several root cause which creates the different interpretation, understanding and expectation of the rubrics. Some of the employers reported that, they did not have the educational expertise to provide appropriate feedback relating to the academic components of the assessment. Some host companies (and even the academicians) might wonder what is "actually" need to assessed, how broad or deep each criteria is etc. Some of the questions that should be asked are :

Does grading focus on the student's ability to communicate their workplace learning experience or is it simply based on the success of their project?

Do the host company have the pedagogical and assessment skills required and if so, what quality assurance and moderation processes apply and how can this process be made equitable for all participating students?

There are also other issues surrounding the complexity and degree of difficulty of the internship tasks which are likely to vary and may require varying degrees of effort and time for successful completion and many more. According to [10], unless there's a written agreement between the host company , the university and the students, this issues will be very difficult to solve.

Therefore, given the unique nature of industrial training program, it may be difficult to develop a standardized assessment instrument, hence, introducing a gap between the academic expectation and the host company's interpretation of the expectation [7],[11]. This expectation gap, as discussed earlier, may result in inconsistency (reliability) and validity and thus might have adverse impact on the overall performance of the student's achievement. In addition, there may exist some grey areas and potential issues/questions surrounding assessment tasks by the host companies. Even though, an effective assessment instruments (with rubrics) was established, due to the aforementioned difference in expectation/interpretation between academic and host company, there's a definite possibility that both marks will greatly differ and has huge variance, although both are measuring the same performance indicator, such as knowledge, communication skills etc.

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Therefore, the purpose of this research is to investigate whether there exist any significant gap between the expectation of the host company and university for the internship program in Universiti Teknikal Malaysia Melaka (UTeM), in particular for the Electrical and Mechatronic Engineering degree program. In detail, the first step is to determine the level of the assessment from both the host company and the faculty supervisors/university and then, to determine significant difference of the assessment results between the host company and the university. If there's a significant gap, then, the next stage of potential investigation is to identify the potential causes and thus to propose preventive measures that potentially will reduce the gap.

IV. METHOD OF THE STUDY

Based on the objectives explained earlier, the research questions established are: For each of the learning outcome :

- What is the mean value for each of the assessment result from the host company?
- What is the mean value for each of the assessment result from the university/faculty?
- Is there any significant difference between the results?

The research approach adopted was qualitative in nature with data acquired using questionnaires from the industrial training assessors, namely the faculty supervisors and the industry supervisors in order to obtain views from a wide variety of perspectives. For this study, a sample of assessment marks for 322 students were analysed. The data obtained are on the assessment result comprising of all 3rd year engineering students of Faculty of Electrical Engineering, Universiti Teknikal Malaysia Melaka who enrolled in the industrial training program in 2013.

A correlation analysis from the data obtained was carried out in order to examine the correlation between industry supervisor evaluation and faculty supervisor evaluation. Pearson's correlation coefficient will be calculated to determine the strength of the relationships between variables. Pearson's correlation coefficient value varies between -1 and +1. A relationship of -1 and +1 would indicate a perfect relationship, negative or positive respectively, between two variables. The complete absence of a relationship would engender a correlation coefficient of zero. The nearer correlation coefficient to zero, the weaker is the relationship [12].

A *t*-test analysis was carried out to determine whether there exists a significant relationship between both supervisor evaluations. The null hypotheses, which is, for the six assessment criteria, there is no significant difference between industrial supervisor evaluation and faculty supervisor evaluation. The alternative hypotheses will be the compliment statement from the null hypotheses. Next, the descriptive statistics for each criteria was calculated to support result gain from the *t*-test.

V. RESULTS AND ANALYSIS

Table 2 provides the value for correlation coefficient and *t*-test with the associated *p*-value for the test. Observing the value of the correlation coefficient for each item, it is clear that all the values are close to 0.Hence, the correlation between industrial supervisor and faculty supervisor can be said as does not exist at all. As the correlation coefficient failed to prove the existence of a relationship, the analysis continues with the *t*-test to determine the significance difference in student evaluation between faculty supervisor and industry supervisor.

By taking the significant level; $\alpha = 0.05$, result from the *t*-test reveal that all the *p*-values for communication skills, critical thinking and problem solving, teamwork, ethics and moral/disciplines and lifelong learning are less than α. Hence, the null hypotheses for these items are rejected. On the other side, the null hypothesis is accepted for technical knowledge as the *p*-value for this item is greater than the significant level.

TABLE 2: Correlation coefficient, *t*-test and *p*-value results.

LO	Supervisors	Correlation Coefficient	*t*-test	*p*-value
Communication Skills	Industrial supervisor	0.073	8.803	0.00
	Faculty supervisor			
Technical Knowledge	Industrial supervisor	0.006	-0.189	0.85
	Faculty supervisor			
Critical Thinking and Problem Solving	Industrial supervisor	0.113	15.463	0.00
	Faculty supervisor			
Teamwork	Industrial supervisor	0.015	25.937	0.00
	Faculty supervisor			
Ethics and Moral / Disciplines	Industrial supervisor	0.103	27.591	0.00
	Faculty supervisor			
Lifelong Learning	Industrial supervisor	0.026	-23.897	0.00
	Faculty supervisor			

Therefore, with a 95% degree of confidence, below are the conclusions that can be made for the significant difference test:

- There **exist a significant** difference between industrial supervisor evaluation and faculty supervisor evaluation for FKE industrial student's **communication** skills.
- There is **no significant difference** between industrial supervisor evaluation and faculty supervisor evaluation for FKE industrial student's technical knowledge.
- There **exist a significant difference** between industrial supervisor evaluation and faculty supervisor evaluation for FKE industrial student's critical thinking and problem solving.
- There **exist a significant difference** between industrial supervisor evaluation and faculty supervisor evaluation for FKE industrial student's teamwork.
- There **exist a significant difference** between industrial supervisor evaluation and faculty supervisor evaluation for FKE industrial student's ethics and moral / disciplines.
- There **exist a significant difference** between industrial supervisor evaluation and faculty supervisor evaluation for FKE industrial student's lifelong learning.

In order to observe the existence in the difference between industrial supervisor evaluation and faculty supervisor evaluation, an analysis on the descriptive statistics was done. Table 3 provides the descriptive statistics for each aspect for the assessment from the host company and the faculty supervisors.

TABLE 3: Mean, Standard deviation, Mod, Max and Mean values

LO	Supervisor	Mean	StDev	Mod	Max	Min
Communication Skills	Industrial supervisor	8.45	1.16	9	10	4
	Faculty supervisor	7.58	1.428	8	10	3
Technical Knowledge	Industrial supervisor	11.09	2.106	12	14	0
	Faculty supervisor	11.12	2.072	12	16	5
Critical Thinking and Problem Solving	Industrial supervisor	10.45	2.064	12	13	0
	Faculty supervisor	8.36	1.529	9	12	2
Teamwork	Industrial supervisor	2.72	0.484	3	3	1
	Faculty supervisor	1.92	0.273	2	2	1
Ethics and Moral / Disciplines	Industrial supervisor	5.19	0.793	5	6	2
	Faculty supervisor	3.87	0.43	4	4	0
Lifelong Learning	Industrial supervisor	3.25	0.605	3	4	2
	Faculty supervisor	4.68	0.904	5	6	1

Referring to the mean value for technical knowledge criteria, it can be observed that the average marks given by both supervisors are almost the same. Hence, it is proven that there is no significant difference between industrial supervisor evaluation and faculty supervisor evaluation for student's technical knowledge. Majority industry supervisor and faculty supervisor give a marks of 12 for student's technical knowledge. However, there is high difference in the minimum marks given by faculty supervisor, which is 5, and 0 for industry supervisor.

For communication skills, teamwork and lifelong learning, there exist a slight difference in the average marks given by industrial supervisor and faculty supervisor as proven by the mean value for each supervisor. Apart of this, the highest frequency marks, the maximum marks and the minimum marks given by both supervisors to industrial training students also differ by about 1 to 2 marks.

Referring to the value of mean for critical thinking and problem solving and ethics and moral / disciplines, there exist big differences in the mean marks given by industrial and faculty supervisor for these items. The average marks given by industrial supervisor for student's critical thinking and problem solving is higher than faculty supervisor by about 2.09 marks. Moreover, the highest frequency mark and the maximum marks from industrial supervisor are higher by 3 marks and 1 mark respectively as compare to faculty supervisor marks. On the other hand, one sample of FKE industrial training student which was rated (by industrial supervisor) as unable to identify and solve problem even with assistance. Instead, the lowest marks given by the faculty supervisor for a student is 2 marks. Both implies that the student needs assistance to identify, analyse and solve a problem.

From the Table 3, it is also proven that there exist a significance difference in student's evaluation by both industrial and faculty supervisor for ethics and moral / discipline as the average marks are differ by 1.32. About 47.5% of industrial supervisor rated FKE industrial training students as able to identify, make notes and apply good professional and ethical practices performed in the company. For faculty supervisor evaluation, the highest frequency marks given is 4, meaning that 88.8% of faculty supervisor rated FKE industrial training students as able to identify and make notes but unable to apply good professional and ethical practices performed in the company. The result gain is supported with the maximum marks given by industrial supervisor; 6 marks and faculty supervisor; 4 marks respectively. Observing the minimum marks for ethics and moral / disciplines, a total of 3 industrial supervisors (out of 322) evaluate the students as aware of good professional and ethical practices in the company without taking notes and applying it. In contrast with faculty supervisor evaluation, the lowest mark given is 0, which implies that one of the industrial training students is unaware of any good professional and ethical practices performed in the company.

Referring to the value of standard deviation for each item in the above table, it is shown that the standard deviation for these data is small. A low value of standard deviation for both industrial and faculty supervisors indicates that the dispersion of the data is clustering around the mean.

CONCLUSION

In conclusion, except for the technical knowledge criteria, there exist a significant difference between industrial supervisor evaluation and faculty supervisor evaluation for the industrial training for the students of Faculty of Electrical Engineering, University Teknikal Malaysia Melaka. It is therefore clear that, even by using the similar assessment rubrics, there exist a significant gap between the interpretation and expectation of the faculty supervisors and the industry supervisors of the assessment for the communication skills, critical thinking and problem solving, teamwork, ethics and moral/disciplines and lifelong learning.

The detail root cause of why this gap is yet to be solved in this study since it requires further investigation. The followings are some recommendations for further investigation and future improvement:

1. Create a detail and activity-specific learning contract between each students and the industrial training provider to reduce ambiguity between the faculty and industrial supervisors.
2. Provide platform for the industrial supervisors and faculty supervisors to periodically assess and evaluate on the expectation gap in industrial training
3. Refining and reviewing the current assessment rubrics to reduce potential grey areas of expectation and interpretation.
4. To carry out benchmarking process on best practices of implementing industrial training from other academic institutions.

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