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Industrial Training as Gateway to Engineering Career: Experience Sharing

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Abstract

Today's engineering education demands in-depth theoretical knowledge as well as hands-on exposure to the profession. Traditionally, theoretical engineering education is achieved in campus through direct teaching and laboratory learning. However, hands-on exposure or real world confrontation provides engineering students with on-the-job experience. This helps them to decide whether their skills and industry are a good match. For specialised industries, such as manufacturing, aerospace and electronics, industrial training provides the opportunity for students to gain the most rewarding and enlightening working experience in related companies. This paper examines the industrial training experience gained by the students through a 12-week attachment period specifically looking at whether the companies have been successful in providing a relevant engineering workplace experience. A few industrial training experiences by students will be shared highlighting the positive and negative aspects. This study also suggests some steps that can be taken to ensure companies run industrial training programs that do meet the faculty's expectation.

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1. Introduction

There are growing trends in industry for engineering graduates to possess certain fundamental skills. Educators and trainers of future engineers should take into account all these characteristics desired by employers of our graduates.

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Employability of our engineering graduates very much depends on the skills they possess to bring into the workforce. In [1], it is documented that around 20% of the UK's productivity gap with France and Germany is attributed to the lack of UK's workers' skills. An employers survey done in Scotland showed 12,000 out of 65,000 vacancies to be hard to fill because applicants lacked the necessary qualifications or experiences [2].

The emphasis on skills has led to changes within the Higher Education, which has always been a blend of vocational and academic elements in engineering. Within higher education, in the UK and abroad [3- 4], there is an increasing recogninition of the need to enhance student's employability. Elements of skills and competencies are being given full emphasis. This is also reflected in the Malaysian Engineering Accreditation Council directives when assessing accreditation of the engineering programmes by higher education institution in Malaysia.

Employers need graduates who can help them deal with change and it is not enough for higher education institutions to simply list the skills they have developed [5]. Therefore, there must be a holistic approach to integrate knowledge, work experience and technical and interactive skills development and reflecting on how these can meet the needs of a flexible organisation.

1.1. Industrial Training as Gateway to Engineering Career

The completion of an industrial training period, or work placement period is a positive benefit to both graduates and employers, particularly in an era that stresses on the economic contribution of higher education through developing graduate employablity. The benefits of such training can be twofold; firstly, industrial training contributes positively to the development of generic employability skills; and secondly, placements provide a 'head start' for graduates at the outset of their careers [6]. Even in courses such as business and management, positive association between a work placement and skill development can be observed.

Industrial training in engineering is very important to give an insight on how the industry operates, and to provide the necessary engineering career exposure. A project has been conducted by the American Electric Power (AEP) by conducting a summer intern program, to interest undergraduate engineering students in the power industry [7]. This project arises because of the decline in power engineering status at many US universities. In this project, AEP provides a period of summer internship at their establishment, by the selection of manageable real projects to be solved by the students during their internship period. All disciplines of engineering such as mechanical, electrical, civil and chemical are involved. Students were expected to complete memos, reports and presentations as a normal engineer would do. Students developed a better understanding of engineering, and improved their productivity, communication skills, retention of knowledge gained through lectures, and increased overall enjoyment of the program. The program also fostered improved communication and interaction between academia and industry.

2. Methodology

This paper aims to share the experiences of the students, in particular those from the Department of Electrical, Electronics and Systems Engineering of the Faculty of Engineering and Built Environment, the National University of Malaysia, during their 12-week period of industrial training.

Firstly, the paper will describe some background on the industrial training course. The course outcomes will be highlighted to emphasise on what the faculty hopes the students will achieve during their industrial training period. Then, some aspects of their training will be shared, for example, their daily assigned tasks. Positive and negative aspects of their experiences will be highlighted. Company names will be anonymous, to protect their identity.

Finally, the paper will look at some suggested steps that can be taken to ensure the companies provide a training that would meet the required course outcomes.

2.1. Industrial Training course in the faculty

Industrial training is a compulsory course to be taken by all engineering students from the faculty. The course labelled as KKKF3066, is being monitored at the faculty level. However, one co-ordinator is appointed to oversee all industrial training activities in their respective departments. The experience shared in this paper is as shared by the co-ordinator for the Department of Electrical, Electronics and Systems Engineering.

As the faculty has both engineering and architecture program, the requirements are slightly different for both programmes. The objectives of the course is highlighted in Figure 1.

KKKF3066 Industrial Training Course Objectives:

- To provide exposure to students to specific engineering or architecture practices in the respective fields and types of of industries selected
- To provide exposure to students to responsibility of becoming an engineer or architect and the profession of engineering or architecture
- To instill communication skills in engineering which include daily interaction with the working environment and technical writing.

Fig. 1 – KKKF3066 Industrial Training Course Objectives

After the period of training, it is expected that students should achieve the course outcomes below:

- Recognised the duties, responsibilities and ethics of a professional engineer.
- Ability to communicate effectively in the work environment.
- Understand general and specific work procedures in the field of engineering in the industry.
- Gain exposure and practical experience in the relevant field.
- Ability to prepare technical reports for the training.
- Ability to apply knowledge learned to solve problems in the industry.

The duration of the training would usually be around 10 – 12 weeks during Semester III. Engineering students would have to have already completed their third year, and for architecture students, their second.

The course is assessed through four components, as follows

1. Log Book

The log book is used by the students to record their training details, and can serve as a daily record for tasks performed during the training. It is the responsibility of the student to record all notes in the log book and to keep the content updated. Each daily record is to be verified by the supervisor. The Log Book should contain objectives for each daily activities, list of tools used, process flow diagrams, flow charts, sketches, data and related circuit diagrams, results and outcomes of the activities, constructive comments, analysis and references to text books, standards and other technical information.

2. Employer's Survey

This is an assessment by their direct supervisor of the external organisation, by filling a survey form in the Log Book. The employers are expected to rate the students according to a 1 to 5 Likert Scale, based on the criteria given.

3. Communication, Ethics and Professionalism

This aspect is assessed through a 15-minute seminar presentation by the students. In the presentation, students are expected to highlight their experience obtained during their training. Marks for this component can also be improved by obedience to all procedures and directions by the coordinators during the application process, the acceptance for industrial training placement, and the students adaptation to the working environment at the training place. Some input on students and company performance are also shared by the visiting lecturer to the industry.

Based on these items, grades from A, B, C and E are given to the students. Although this course is not included in their Cummulative Grade Points Average (CGPA) calculation, a grade other than A would be predictive of their expected performance in industry later on.

3. Experience Sharing

3.1. Positive aspects

A very interesting training period is one that is experienced by a student from the Electrical and Electronics program. His attachment is with a company providing engineering solutions based on control instrumentation and software. Although the company is categorised as a Small and Medium Enterprise (SME), the vast involvement of the companies with major engineering projects provided invaluable experience to the student. This company also has experience in offshore projects although the student did not have the chance to do such projects because of the short training period. In his daily task, the student is involved with calibration of instruments, wiring of control panel, digital and analog processing, fitting of instruments, testing of installation, as well as trobleshoooting. The student also had a chance to design a panel which was later implemented and tested to be working perfectly.

Another student had a chance to be attached to a large LED light manufacturer. This student had many opportunities for hands-on work involving lighting. Basically, he was involved from the initial steps of targeted filament colour evaluation, colour recipe for solar function transformation, and phosphor mixing. All these very delicate work is very crutial in producing the right colour performance of an LED bulb. The exposure to dangerous chemicals exposed the student to the standard safety measures taken by industries. Also, the student became very good in communication skill as he has to be able to translate all the technical terms when communication with his fellow work colleagues from different departments.

In Malaysia, there are many integrated circuit (IC) design company. These companies design, develop and market their IC products to be used in telecommunications, industry processes, instrumentation, and others. A student from the Microelectronics program had an industrial training with this company, and was exposed to various techniques in IC design. The training period has been devided into three modules, where the student had a chance to experience three different major steps in IC design. However, since the period of training is very short, the student was only exposed to the first module which involved the fabrication process and device

characterisation using the latest technology. However, the student now appreciates the type of work involved in his field of engineering.

One interesting training period is obtained by a student at an electronics sistem design company. This company manufactures instruments and the associated softwares. As a result, the experience obtained by the student is in the latest software development and programming language, debugging problems when designing and testing a completed system, algorithms for signal analysis, and product documentation. These are all real engineering activities that would be faced by any engineer involved in such operations.

Another student obtained a training period at a power generation company. The most important aspect in the operation of a power generation company is safety. Thus, the student is made aware of safety aspects in everything that happens in the power plant. The student experienced the process of power generation which would normally been obtained through lectures. Some other exposure are in the areas of preventive maintenance, failure detection, turbine, loading, cooling system, circuit breaker functions, lubrication, fuel valves, air circulation, and control centre.

3.2. Negative aspects

One important aspect in obtaining a relevant industrial training is the match between the students enrolled degree program and the type of company providing the training. However, this sometimes cannot be fulfilled as students often did not consider this aspect during their application period. Thus, they cannot fully appreciate the experience they obtained during their training period. For example, a student from the Microelectronics program, attended training with a development and maintenance based company. As a result, the student could not fully understand the operation and technical aspects of her allocated projects since the student has not got any basic knowledge in that area.

Another experience encountered is with a company that is a provider of entrepreneural training. This company is tailored into providing support for the promotion of certain business products. Therefore, although the student is exposed to numerous training sessions on self-development, none of these training provide the relevant engineerng experience which would be required by the student to prepare himself for an engineering career.

A student from the Microelectronics program obtained a training placement at a large manufacturer for automotive parts. However, his training mostly involved the management of foreign workers. This student is in charge of training the workers who have been freshly shipped from their country in the aspects of work environment and language. His other scope of work also involved management of stocks that arrive for storage. These kind of job scope would not provide the student the necessary engineering career insight.

The aspects of product and business confidentiality is an important aspect that has to be balanced by the companies when providing adequate engineering training. One experience gained by a student involved a large electronics manufacturing company which has a parent company in Japan. However, during most of the training time, the student is mainly involved in observation and monitoring of general operation of the production line, stock checking, and recording employers complaints. One would expect that such a big company would have a vast range of mini electronics projects that can be assigned to the student.

4. Suggested steps to improve the industrial training experience

As highlighted above, there are many aspects to the training that are positive and contributes to the overall engineering career exposure to the students. Such training provide the real-life, hands-on, practical experience

that could not be obtained in class. However, some negative experiences do happen, and such experiences would need to be prevented in the future to ensure the best training experience by the students.

There are many steps could be taken to ensure good positive industrial training experience. Firstly, is to ensure all companies providing industrial training do understand the expectations of the faculty for the training period. This can be achieved by giving some information pack with the necessary details, and can be displayed in the faculty website.

It might be necessary to check all companies before students placement, as to whether they are able to provide the suitable relevant engineering experience. This can be obtained through personal contacts, or through previous students industrial training period. As the university has established a database of companies providing industrial training experiences, some notes on the background and the ability of the company to provide adequate training should also be included. Then, the students can make an informed decision during their selection of companies. A centralised database of all previous seminar presentations should be available at all times so students can choose companies that can provide a good and relevant training experience.

Thirdly, visits by lecturers can be done earlier on during the training period, so necessary steps can be taken in case there are problems. However, this must be balanced since too early a visit would means the company is unable to give adequate feedback on the students performance during their training. Organising another visit towards the end of the training period would put constraints on the faculty's budget, and might not be necessary since company feedback can also be obtained from the Employer's Survey.

Lastly, to enable students to select companies that are relevant to their degree program, it might be useful if the university database of companies includes information on the company types of business. Some categories would be construction, electronics manufacturing, electronics fabrication, engineering consultancy, power generation and information technology related

5. Conclusion

This paper has shared the industrial training experience obtained by students from the faculty during their 12-week training period. Some aspects of the training has been highlighted. Although there are negative aspects such as inability of the company to meet the expected outcomes for the course, the numerous positive aspects such as good organisation, all rounded experience, and access to the latest technology in engineering, should be the driving force to the continuous implementation of this course for the students of the Faculty of Engineering and Built Environment.

It is through this course that students can obtain real-life, hands-on experience on the engineering career before they graduate. The success of this course do depends on the companies to provide the necessary, relevant experience to match the targeted outcomes.

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