THE EVALUATION OF COOPERATIVE WORK PLACEMENT IN MECHANICAL ENGINEERING PROGRAM AT THE UNIVERSITY OF HA'IL, KINGDOM OF SAUDI ARABIA

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ABSTRACT: *At present, growing concerns from industries about poor education and training quality had forced institutions of higher learning to seek ways and means to improve their education and training quality. In order to achieve this objective, one of the efforts is to conduct a customer's satisfaction survey focusing on the cooperative work provided to their students. This research focuses on a survey conducted on Mechanical engineering students at University of Hail, Kingdom of Saudi and employers that participated in the cooperative work placement program. This survey uses questionnaire to measure the students' and employers' perception as regards to their satisfaction level. This survey questionnaire was based on satisfaction factors to suit the context of industrial environment. The research concludes by discussing the customers survey satisfaction results and proposed some recommendations to improve the customers' (i.e. students and employers) satisfaction in future cooperative work placement programs.*

Keywords: cooperative work placement, mechanical engineering, theoretical knowledge, engineering practice, educational standard

1. INTRODUCTION

Rapid growth of infrastructure development in KSA recently has increased chances of job market to many graduated students. In order to keep up with the demands, universities hold responsibility to produce students with sufficient background and excellent qualification. By working more closely with industry, higher education institutions will be able to produce graduates who are more likely to succeed in the workforce and more aptly skilled for gainful employment.

The work placement program exposes the students to professional skills and experiences in industrial engineering practice. In preparing the students for the real working environment as an engineer, cooperative work placement helps to produce engineering graduates with technical and soft skills competency. According to Burnet, G. and Greisch [1] the first cooperative education or cooperative work program was founded in 1906 by Herman Schneider, Dean of the College of Engineering at the University of Cincinnati Ahmed, P. K. and Rafiq, M. [2]. Since then, many institutions have adopted the cooperative option in engineering education. Nowadays, to ensure quality in cooperative engineering programs, the Accreditation Board for Engineering and Technology (ABET) has developed standards in this regard. According to M. Zhurakovsky [3] the methodology of the optimum development of the requirements of a graduate of an engineering higher education institution consists not only in the accounting of the approaches and views of the spheres of higher education and the professional activity of the expert, including the common and peculiar features of the modern technology worker, but also in the accounting of all communications of the identity of the professional with society, the environment and the professional sphere. Such communications are basic, focusing on the formulation of the requirements for the programs of higher technical education and for implementation of the educational standards of vocational training.

Therefore, by bridging the skills and knowledge gathered from the learning place to work place has long been a concern of training institutions and industry. For example, modern cooperative work placement programs strive to address needs of the learner, the training institution, and the industry. They are called by a variety of names such as cooperative education, field experience, service learning, field-work, practical training, on-job training, in-plant training, externship and apprenticeships [4]. A critical role of any organization is the identification and fulfillment of their customers' needs. Thus, for achieving a quality service to success is not just satisfying customers, but to delight the customers. Therefore, according to Ahmed, P. K. and Rafiq, M. ([2] in order to satisfy and delight the customers requires a customer orientation.

Rapid growth of infrastructure development in KSA recently has increased chances of the job market to many graduated students. In order to keep up with the demands, universities hold responsibility to produce students with sufficient background and excellent qualification. As an assurance for the performance of students is up to the standards, preparation and exposure to the cooperative work placement is a must in the programme. In order to fulfill the requirements of the degree regulations, and the expectations of Saudi Council Engineers, Kingdom of Saudi Arabia (KSA) and the Accreditation Board for Engineering and Technology (ABET) all engineering students must complete twenty eight weeks of approved engineering work experience and submit a written report detailing the experience

University of Ha'il. The cooperative work placement must be completed before the degree can be conferred and it is undertaken during the summer vacation (mid-November to February), after completing three years (6 semesters) of studies and before complete academic studies [5].

The cooperative work placement exposes the students to professional skills and experiences in industrial engineering practice. In preparing the students for the real working environment as an engineer, cooperative work placement helps to produce engineering graduates with technical and soft skills competency. The cooperative work placement is offered in the semester break between 6^{th} semester and 7^{th} semester. The students are attached for 28 weeks training at various industries in Kingdom of Saudi Arabia [5]. Students earn six credit hours after the completion of te cooperative work placement. This research investigates the perceptions of the undergraduate students from Mechanical Engineering Department on their cooperative work placement programme. Therefore, by bridging the skills and knowledge gathered from the learning place in the work place has long been a concern of training institutions and industry. For example, modern cooperative work placement programs strive to address the needs of the learner, the training institution, and the industry. They are called by a variety of names such as cooperative education, field experience, service learning, field-work, practical training, on-job training, in-plant training, externship and apprenticeships [4, 6]. A critical role of any organization is the identification and fulfillment of their customers' needs. Thus, for achieving a quality service to success is not just satisfying customers, but to delight the customers. Therefore, according to Ahmed and Rafiq [8], M. Zhurakovsky[7], Hill, N [8] in order to satisfy and delight the customers requires a customer orientation.

The co-op training course represents a great method for students to achieve the program outcomes due to its many objectives and course outcomes. The course outcomes and their relation to Mechanical Engineering program outcome (based on ABET student outcomes a-k) are listed below. For each outcome, the related a-k outcomes are shown between parentheses (ABET 2015) [9].

- Ability to apply learned academic knowledge and skills in the work environment (a, k).
- Ability to identify and formulate engineering problems (e).
- Ability to function on a multi-disciplinary team (d).
- Ability to communicate orally and in writing (g).
- Ability to successfully complete industrial tasks and contribute to the company (k).
- Ability to gain and develop employability skills (f, h, k).
- Ability to embrace new learning opportunities and challenges (i).
- Ability to use critical/creative thinking in decision making and problem solving (a, e).
- Ability to develop personal management skills related to time, organization, and stress (a, k).
- Ability to analyze engineering problems and suggest solutions (a, c).
- Ability to develop criteria to evaluate suggested solutions, and select the preferred one (h, k)

Below is the list of Mechanical Engineering program outcomes (based on ABET criteria *a-k*): Upon successful completion of the Bachelor of Science program in IEM, graduates will have:

- An ability to apply knowledge of mathematics, science, and engineering.
- An ability to design and conduct experiments, as well as to analyze and interpret data.
- An ability to design and improve integrated systems of people, materials, information, facilities, and technology.
- An ability to function as a member of a multi-disciplinary team.
- An ability to identify, formulates, and solves Industrial Engineering & Management problems.

As an assurance for the performance of students is up to the standards, preparation and exposure to the cooperative work placement is a must in the program this paper is to describe the experience and lessons learned from implementing the cooperative training at the Mechanical Engineering program at the University of Hail. The objectives are to analyze the impact of the co-op training on the performance of the students and to study the role of the co-op training in enhancing meeting Accreditation Board for Engineering and Technology (ABET) criteria.

2. RESEARCH METHODOLOGY

Assessment of the training will be made by both the host organization and the university. The university work together with the host organization to identify sets of skills needed, method of measuring these skills and assessing those measurements. The student will be placed under a supervisor, appointed by the host organization. The university in turn appoints a course coordinator.

Due to KSA is a big country and many students do cooperative work everywhere in KSA. The appointed academic staff of the University will visit the students in order to monitor and to evaluate the students during cooperative work placement program. As results, the university can evaluate the practical students' working environment along the cooperative work period.

There are many methods available for obtaining information about people perceptions, and beliefs. The most common and widely used methodologies by the social science researchers are the experimental research, the co relational research, historical research, descriptive research, and survey research. In the case of survey research, the self administered questionnaire form is the most common form of research method for surveying or measuring people's opinions, belief, perceptions or interests Hill, N. (1996).The self-administered questionnaire form to be filled up by the respective respondents and collected upon their completion. Survey respondents were aimed at those students who are undergoing their cooperative work program and the respective industrial providers, companies and industries. In this survey, the questionnaire forms were distributed by the industrial officers/supervisor who visited the students while they are undergoing their cooperative work placement at the

respective companies' site and collected the completed questionnaires before leaving the companies.

3. RESULTS

As shown at figure1, 40% students preferred their cooperative work placement in manufacturing sectors, 17% oil and gas sector, which is second popular choice among the students especially at ARAMCO, SIPCHEM and SABIC. Some students' choose energy sector at Saudi Electric Company, Hail International Airport in Service sector, Ma'aden Saudi Company in mining and Almarai Company in food industry. As the whole industrial supervisors satisfied with the performance of business students during cooperative placement, As shown in figure 2; the six most skills rated as excellent and good by industrial supervisor, they are: punctuality (62%), team work (68%), relation with supervisor/mentor (75%) and they also satisfied with students honesty, attitude, appearance and adaptable to the engineering working environment. Mean scores are derived to determine whether the students have positive or negative perception regarding the internship programme. As a five –point likert scale was used, a mean score of more than three is treated as an indicator of a favorable response from the students. Mean scores of the key variables are shown in the Table 2 below.

As shown in table 1, student rating is 11 percent for the item "you received maximum opportunity for training in each department of your company". According to this percentage it is obvious that students have lower opportunity to get the internship covering each department of the company. Also 31 percent rating is given for the item "your organization carried out an evaluation after finished internship". Majority of students with 31 percent have marked that Host Company does not carry out an evaluation after the work cooperative placement program.

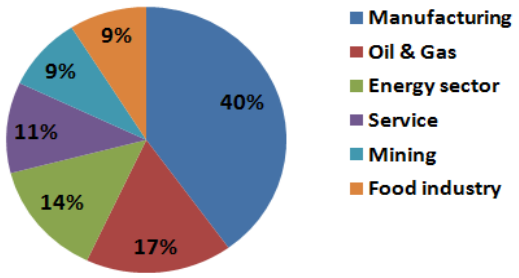

Figure1 Cooperative work placement sectors

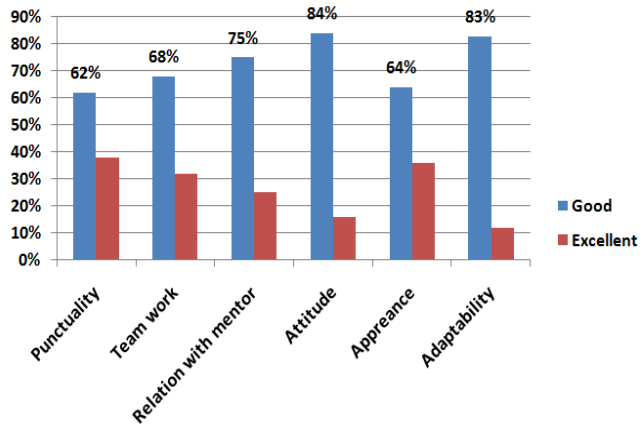

Figure 2 Perception of the company

Table 1 Organization support

Factors	Students
Internship Training was highly related to your course or degree	63%
Company provided real job experience	74%
Your company carried out an evaluation after finishing cooperative work placement	31%
Company was supportive in providing transport/meal/allowances	78%
Company provided Well-structured training to cover all areas in the Company	78%
You could built good rapport with your Mentor	72%
You received an opportunity to train in each Department of your company	11%
There is a flexibility to attend university activities during your cooperative work placement	62%

Table 2 Efficiency of the pre placement activities

Factors	Agree/ strongly agree
The comprehensive guideline was provided by University internship unit	61%
The efficient placement procedures was carried out to select your training places	63%
The briefing given by University internship Unit was sufficient and informative	58 %

Table 2 above shows the students' perception regarding the pre-placement activities provided by cooperative work unit. Generally ratings are above 60% of the students' perception as "agree" or "strongly agree". However, "The briefing given by University internship Unit was sufficient and informative before starting the internship" rating is 58%. Therefore students' ratings are relatively favorable for this variable.

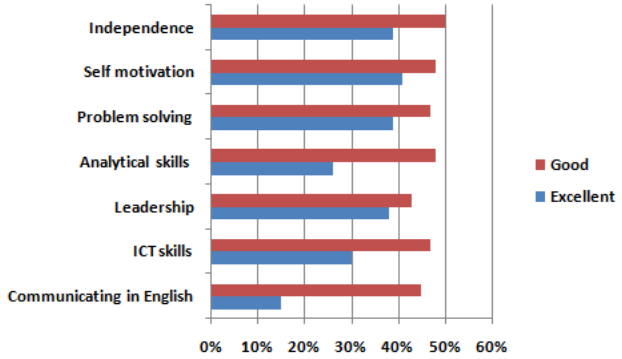

Figure 3 Evaluation of industry of Mechanical engineering trainees as excellent and good (2014/5) academic session

The partnership with industry in the work cooperative placement program provides valuable feedback on the work-readiness of trainees. Such feedback can then be used to gauge the employability factor of University of Hail graduates and enhance current teaching and learning program. The majority of the respondents rated the trainees as excellent and good in these items (see figure 3), which suggests that Mechanical engineering students do possess the much talked about soft

skills required for a person to be considered. However, the difference between excellent and good rating for all of these skills are acceptable, except for communicating in English and analytical skills, needs to be addressed for Mechanical engineering students to move towards a higher percentage of its trainees being rated excellent in line with its focus on producing high quality graduates.

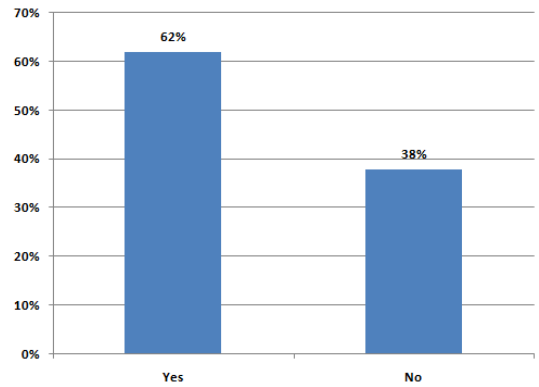

Figure 6 Industrial training should be near to the residential Area

62% trainees have supported the fact that the place for Cooperative work placement training should be nearer to the residential area as shown in figure 6. It is important to note that most of the trainees prefer to work in Hail and some of them are not ready to travel far away from their homes. Thus by making the arrangement of training centers nearer to the universities or within the universities, chances of well trained mechanical engineering students will be more.

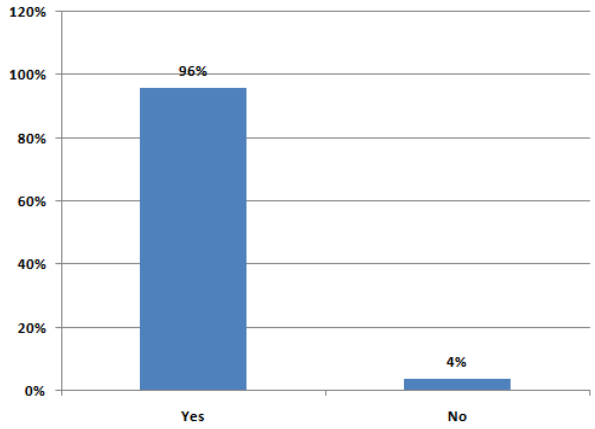

Figure 5 Chances of employment are better after completing the industrial training

Industry always looks forward for talented staff. Training is a mode through which trainee interacts with the industrial staff. It provides an edge to superiors in the industry to understand the trainee's talent, potential, interpersonal and attitude skills which help them to recruit the manpower which suited best to them. Through work cooperative work placement, industry is also able to generate data of the potential viable candidates to be absorbed at a later date as per the need of the industry. It has been observed that 96% Mechanical engineering students, as shown in figure 5, strongly believe that students who have a positive experience with a company will be more likely to apply for a job and chances for getting job are much better.

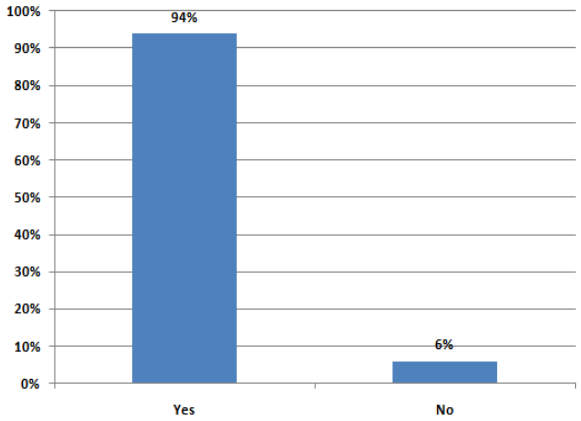

Figure 7 Enhancing technical and managerial skills

Industry always looks forward for talented engineers. Work placement training program is a mode through which trainee interacts with the industrial staff. It provides an edge to superiors in the industry to understand the trainee's talent, potential engineering and managerial skills which help them to recruit the manpower which suited best to them. Through training, industry is also able to generate data of the potential viable candidates to be absorbed at a later date as per the need of the industry. It has been observed that 94% Mechanical engineering students, as shown in figure 7, strongly believe that students who have a positive experience with a company will be more likely to apply for a job and chances for getting job are much better.

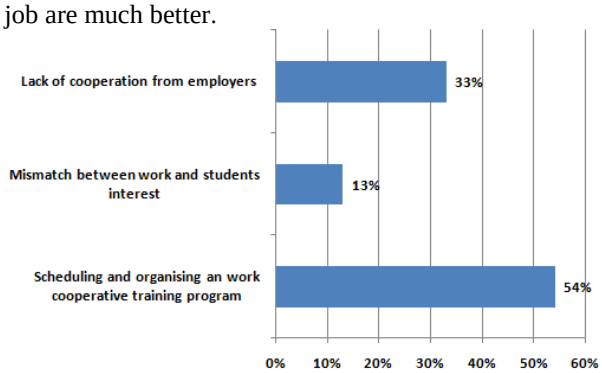

Figure 8 problems faced during the work cooperative placement training tenure

As shown in figure 8, scheduling and organizing work cooperative training program is a difficult task (54%). Full cooperation is needed from various parties, the student, the coordinators of industrial training, and the host company. Among the major problems faced include scheduling between university and workplace, mismatch between work and students interest (13%), lack of cooperation from employers (33%).

4. RECOMMENDATION

Strategies to enhance work cooperative placement program

Per the data presentation and analysis shown above, there are several major areas requiring improvement in the way work cooperative placement training program is currently organized include:

a)The need for University of Hail to provide guidelines for industrial training for use by host organizations and to monitor trainees during industrial training; training companies should design

training program which emphasize all competencies, appoints industrial supervisors and submit industrial feedback to university. This can be done by appointing senior practitioners as external assessors, an advisory board and visiting lecturers to enhance understanding between organisations and institutions.

b) Emphasizing the aspect of case studies, presentation in the curriculum (i.e. 'Problem-Based-Learning' concept)Taking into account the attendance and punctuality criteria in the scoring system.c)Establishing industrial safety subjects in the curriculum ,i.e. Occupational Health and Safety, line supervision, Human factors and Ergonomics, risk assessment, etc d)Improving the English proficiency and communication. i.e. Encourage participation in more presentations).

e) Partnership and collaboration between industry and academia must be strengthened very well

f) Feedback from industry/firms should be made known and discussed with students

g) A stakeholders' meeting could be organized to know what industry expects from trainees.

5. CONCLUSIONS

Base on above finding, it can conclude that as the whole. Exposing the students to the practical experience and actual working environment shall open the avenues for developing their skills and capabilities, as well as enhancing their intellectual and emotional persona. Besides, the college of engineering also hopes to forge the vital industrial linkages that shall pave opportunities for "bridging the gap between industrial and academia" and industrially driven research. It is hereby concluded that, students' industrial training cannot be taken for granted because it does has a great effect on their employability after graduation. Taking advantage on the academic-industry cooperation practice The University of Hail may invite expertise from company to be industrial advisor as they can provide constructive feedback to the undergraduates as a means of sharpening skills which are most sought after by employers nowadays.The study results might also be helpful to academic institutions in the sense of better preparing students for business practical experiences by designing their courses of studies to be more practical.

ACKNOWLEDGMENT

This research was fully funded by the Ministry of Education, Kingdom of Saudi Arabia and Bin Laden Research Group, University of Hail. Research Grant no: 0150131. We would like to give special thanks to the members of the Work Cooperative placement program Unit and the staff team of the Bin Laden Research Group for their endless help in the design, development and implementation of this program.

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