

FORMAL UNIVERSITY EDUCATION AND JOB COMPETENCY OF NEW ENGINEERS IN AUTOMOTIVE INDUSTRY IN MALAYSIA

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ABSTRACT

The main purpose of this research is to verify the relevancy of knowledge and skills acquired by engineering graduates from university to automotive industry in Malaysia. Hence, this paper aims to identify to what extent the knowledge and skills acquired by the new engineers in the university have equipped them with job competency in the automotive industry. This study adopts a qualitative case study method to analyze and compare data collected from a private engineering college, a public university and an automotive manufacturing industry. The identified target groups are one human resource manager, six new engineering graduates, and 4 university lecturers. The findings of this study suggested that the stakeholders, university, students as well as industries are aware that it is not easy for new engineers to fit into industries right after graduation. The study emphasizes the important role of the stakeholders namely; university, new engineer and industry, to enhance the acquisition of knowledge and skills for better job competency of new engineers at the beginning of their career at industry. The results revealed certain attributes showing strong linkage between university education and job performance. In particular, students' attitude, interpersonal skills, lack of manufacturing knowledge, lecturers' industrial exposure, collaboration between university and industry, poor execution of internship, poor training needs analysis and incompetent coach at industry were among the attributes that have high influence on the ability of new engineers coping with the job challenges. The study has contributed to a better understanding of job competency and the challenges faced by new engineers at the chosen automotive industry.

Keywords: *Knowledge, skills, job competency, new engineers, automotive industry*

INTRODUCTION

The automotive industry is a promising industry which contributes to the boosting and evolving economic and industrialization processes which lead Malaysia to a developed country in the foreseeable future (Ukessays, 2013). The recent challenges posed by market liberalization and the pace of changes and growth have generated intense competition in the automotive manufacturing industry worldwide which is impacting the Malaysian manufacturing industries with ventures local and abroad. Hence, the automotive manufacturing industry is recognizing the need to grow and attract more competent new automotive manufacturing professionals. Meeting these needs will result in many challenges to find skilled automotive manufacturing professionals who can lead the industry into the future. One of the most critical issues for this challenge is the expected knowledge that is distinct to the nature of the automotive manufacturing industry. While industry representatives have expressed their concerns regarding the future workforce, very little data is available about the extent of demand, the characteristics and knowledge and skills of preferred candidates, and the role that universities can play. Furthermore, previous researches have identified that students' knowledge is the concern of the problem.

According to Keizrul (2008), "Malaysia is now experiencing a shortage of experienced engineers in certain areas. One of the root causes of the dwindling interest in engineering is the structure of the Malaysian education system". To be an engineer, one should be able to understand the materials and resources, their physical attributes, and their strengths and weaknesses, in order to be able to make improvements to existing products or to create new products. Apart from that, one should be analytical and logical, able to solve problems, and have good communication skills. Furthermore, Christodoulou & Holmes (2013: 6) stated that "The employer's expectation in terms of behavior or performance of the candidate is crucial and critical". In fact, employers are looking for someone who are confident, enthusiastic and a self-starter, to meet the expected increase in demand for graduates. Without the right candidate for the vacancy, more positions will be filled

by individuals without the right knowledge. They must learn all industry specific knowledge on-the-job, as well as training programs organized by the industry. As such the objective of this research is to identify the knowledge and skills acquired by new engineers in the university and on the job. Besides that, the study also aims to identify to what extent is the knowledge gained at the university able to meet the knowledge expected in the automotive industry.

LITERATURE REVIEW

Walton and Austin (2001) highlighted that, industry is criticizing the Civil Engineering curriculum for not properly moulding engineering students for the workplace. Industry wants engineering students who can communicate well, show good teamwork, manage projects and understand the economic situation of their professional activities. Engineering curriculum must make sure that their programs are preparing students to have an understanding of professional practice issues rather than having capability in technical subjects only. For example the American Society of Civil Engineers (ASCE) requires students to have an understanding of professional practice issues. The students must have communication skills, project management capability, pursue life-long learning, and apply creative and critical thinking skills. It is a known fact that an engineer is hired based on his/her technical capability but fired for poor people skills, and promoted for capability in leading and people management skills. Due to this, a suitable curriculum has to be devised to face competitive and complex workplace without affecting the quality of existing engineering program. Hence, ISU CE Industry Advisory Council has developed an integrated curriculum that is a mix of existing course and new courses. This is believed to equip the engineering students with business and performance skills and optimize application of the engineer's technical skills.

The ISU CE Industry Advisory Council has suggested some enhancement areas on CE curriculum. Below is the outcome of the academia review and ISU CE Advisory Council recommendations for the CE curriculum (Walton & Austin, 2001: 1-10):

- Understanding cost estimating, planning, and scheduling

- Utilizing critical thinking
- Communicating effectively to engineers and non-engineers
- Understanding the importance of timely and effective communication
- Working effectively within multi-disciplinary teams
- Understanding the necessity for high professional and ethical standards
- Having basic knowledge of business and management principles
- Interacting with practicing professionals
- Developing leadership skills

In fact, the Task Force has worked on designing an integrated curriculum that is integrating the existing core courses to the new courses to meet the required objectives. Some previous courses were removed and some additional revisions such as technical communication and engineering economics integrated and included into the new CE curriculum. The new CE curriculum consists of the following courses (Walton & Austin, 2001: 1-10):

- Civil Engineering Projects
- Engineering Problems with Computational Laboratory
- Graphics for Civil Engineering
- Civil Engineering Capstone Design
- Leadership Skills
- Team Processes in CE Practice
- Interpersonal Skills
- Communication Skills
- Project Management
- Agreements and Contracts
- Continuous Quality Improvement
- Business Management
- Professional Ethics

ISU faculty has integrated professional practice skills with technical integrity in order for the undergraduate program to remain relevant to the civil engineering job requirement. The new courses are set to educate the engineering students not only on knowledge generation and technical skills but would prepare them for real business requirement and personal skills. Hence, it needs a lot of effort to make any changes to the status quo but realizing the benefit it can bring to the stakeholders would be worth the effort.

Hum, Abdul Aziz and Yohan (2013) further stressed that the common skill shortages of business graduates, especially in the field of business management were poor work attitude and foreign language, inadequate technical skill, and lacked work experience, communication skill, decision-making, analytical skill, and specialized skills. This sort of skills development has become a great challenge for curriculum designers to incorporate in university education curriculum. This has also posted problem, for employers to recruit fresh graduates to fill positions such as human resources, safety, accounting, marketing, sales and service and other supporting functions. As such, it is appropriate to reflect on the practicality of higher education curriculum, specifically business management to meet industries requirement. Business management curriculum must be designed to broaden knowledge and skills that is required by industry to cope with current job demand in a competitive business environment.

To address this pressing issue, the development and practice of business management curriculum must be consistent to national education standards to meet all stakeholders' needs. From time to time the curriculum should be revised by the stakeholders to cope with the quick changes with university board. Universities should form a Quality Assurance Committee to evaluate its curriculum, assess lecturers and students' learning. However, problems like government policy, scarcity of resources, and lack of communication with stakeholders, and lacks integrated approach in teaching and learning environment have resulted in skill gap among graduate employees. Other areas of concerned are the ineffective enforcement of government policies on nurturing relationship between university and industry, misperceptions between university and industry toward skills enhancement, scarcity of resources to innovative programs and poor cooperation between university and industry in sharing feedbacks of academic and employability issues. These are some of the issues that created the gap between university curriculum and industry (Hum, Abdul Aziz & Yohan, 2013).

In an academic environment, educational providers cannot educate students in isolation. Unsuitable curriculum won't be able to prepare students with state-of-the-art skills and knowledge. Without sufficient skills and knowledge, graduates would not be able to perform well in competitive industries and fresh graduates would be an expensive human capital for industry. Thus, everyone involved in the loop have to absorb

the impact directly or indirectly if it is affecting the income of industry. Obviously, the impact caused by curriculum gap is felt by students, faculty, industry and society. Therefore, the stakeholders such as government, line ministries, universities and industries must work together to close the gap. For instance, government should enforce law to facilitate strong corporation between university and industry, university should have more dialogues with industry, and industry should create more opportunities for researchers, educators and students to embark research on employability problem to solve the pertinent issues.

Hence, D'Agostino & O' Brien (2010) suggested that there was a need to redesign curricula of higher educational institutions. The approach should be to enable students to interpret and apply their current methods of theory into the practical environment with emphasis on interaction approach. The university learning experience needs to be enhanced based on the various disciplines of learning. Every discipline of study requires a variation of methods specific to that particular area of study to enhance the learning experience rather than one common approach which is prevalent in higher education environment. Even though higher education is based on disciplinary knowledge and practice, there is an absence of disciplinary epistemologies in the current curriculum, practice of teaching and assessment. Currently, it is apparent that discipline based epistemologies are not incorporated within professional development programs which were designed to aid the staff to gain teaching capability or expertise. Experts in various disciplines joined the academia with limited knowledge of how thinking and reasoning skills can be taught to students. Practical approaches should be used effectively in teaching and assessment by academics in higher education. The current professional development programs which are being offered in universities do not give an opportunity to the academics to deliver an in-depth knowledge of the subject instead a generalized principle of effective teaching is being emphasized. This scenario has promoted a need to review the effectiveness of the methods of teaching. Hence it is essential to examine how university learning experience may be effective to design discipline specific ways of thinking and reasoning for students and how the academia can develop pedagogical expertise to assist in facilitating, support and assess such learning. Hence, an investigation into the methods used to teach and learn in various disciplines would help to bridge this gap. It would be useful to explore various methodologies and develop appropriate

strategies that would facilitate effective learning and assessment specific for various disciplines accordingly.

The quality of learning may be enhanced through appropriate assessment, teaching and learning activities, learning materials and feedback methods. Processes that assist to improve pedagogical changes are more attractive to academics since it involves their expertise from specific disciplines. Moreover, discipline specific methods provide a strong base for faculty staff and educational development staff to draw reference to assess the effectiveness of teaching practice and the quality of learning outcomes. The outcome of this study will help to improve the current curriculum to enhance teaching and learning practice and help students engage and make sense of particular disciplinary epistemologies within classrooms (D'Agostino & O' Brien, 2010).

RESEARCH METHODOLOGY

For this study, the researcher strongly felt that the qualitative research method would be appropriate because it allows the researcher to probe deeply into the heart of the issues surrounding all the stake holders namely, new engineer, university and industry. Finlay (2013) emphasized that qualitative research led to a deeper understanding and was beyond the usual numbers and statistics. In contrast, quantitative research extracted a summary of key issues and was devoid of any rich and comprehensive understanding of the perspectives encountered at work by personnel from both the university and the industry. This is agreed by Chua (2012), that the numerical data produced by quantitative research could not explain the different phenomena in the real world. He felt that there were special cases which required more careful observation to understand the phenomena of emotions, motivation and empathy, and this could not be captured by numbers in a quantitative study. Therefore, in this study, the researcher has used qualitative case study method to discover, understand, and explain in an in-depth manner the perspectives of the universities and industries on their practices, and the impact of contexts on their perspectives and performance. The interview questions used were taken from Laulata (2007)'s survey questionnaire but had been modified to suit the purpose of this qualitative study. Hence, a semi structured open-ended interview questions has been

developed as the data-gathering instrument to document face-to-face interviews with the participants.

For this study, one of the major automotive manufacturing industries located in the state of Selangor have been selected. This Malaysian and Japanese joint venture company which was established in 1970 has been producing non-national cars for the local and foreign market. In order to gauge the information for this study, a total of six new engineers (coded as NE1 to 6), one human resource manager (coded as HRm) and two supervisors (coded as SV1 to 2) were engaged to collect data through personal interviews. Besides that, two lecturers were selected from a private college in Cyberjaya (coded as LEC1 to 2) and the other two were from public universities located in Klang Valley (coded as LEC3 to 4). Overall, six engineers, one human resource manager and two supervisors have been selected to participate in this study.

FINDINGS

Basic Knowledge and Skills Learnt at University

The first theme addressed in this research was, “Basic Knowledge and skills learnt at university”. This question serves to check how useful and how well the new engineers remember the basic subjects they had learnt in university. The common subjects that were mentioned are Manufacturing Technology, Technical Drawing, Statistics and English Communication. In the case of informant NE1, he remembered the Manufacturing Technology, Technical Drawing and Material Science subjects because they were related to his current job at the Welding Department, where he refers to vehicle body parts and its drawings in his daily production work (NE1, 1.1). New engineers from different departments seem to remember different subjects. For instance, informant NE6, who is attached to the Quality Assurance Department, remembered the subjects of Statistics, Mathematics and Engineering Economics (NE6, 1.1). His department is in charge of inspection, collection of data, analysis of data and generation of reports. Informant NE6’s subjects resonate with (SV2, 1.3)’s opinion that engineers should have a basic knowledge in Production Systems, Problem Solving and Good Maintenance or 5S House Keeping to cope with the challenges

at the beginning of their careers (NE6, 1.1). On the contrary, SV1's choice of subjects was inclined towards technical aspects of manufacturing such as Time Motion Study and Total Preventive Maintenance (SV1, 1.3). Supervisors' opinions seem to be biased towards the job nature of their department.

Informant NE3 mentioned that none of the subjects he learnt at university in the faculty of Electrical Engineering was relevant to his current job in Production Planning Department requires him to do planning and controlling for production process (NE3, 1.1). Even when probed about his extra-curricular activities, he was not able to recall any activities which had at least some relevance to his current job. As a matter of fact, he expressed his frustration over his current job which is too disparate from his field of study. In this case, it proves that there is a mismatch between his knowledge and the requirements of his job. Although there were many extra-curricular activities at university, he was not able to relate them to his current job. In contrast, informant LEC2 mentioned that his university organizes extra-curricular project work in groups, special training and talks to impart basic communication skills and foster teamwork spirit among students (LEC2, 1.3). Informant LEC1 also added that his university provides students with projects from industry to expose them to real-life challenges in the industry (LEC1, 1.3).

On the contrary, informant NE2 remembered the general English class that he signed up for in his 1st year and the presentation class in his 3rd year of studies, rather than the technical and engineering subjects (NE2, 1.1). According to him, these language subjects have honed his communication skills and equipped him with the right tools to converse with all staff and also to superiors during project presentations at work. Informant LEC4 (LEC4, 1.3) substantiates informant NE2's (NE2, 1.1) point by stating that:

“It is compulsory for students to attend English communication classes conducted during weekdays in the evenings and during weekend. But how well the students master the subject will depend on how much they believe on the importance of this subject to survive at the corporate world, despite the strong emphasis by the university”.

Informant NE5 also felt that the communication subjects he took in university proved to be valuable because they taught him to deal with different types of people in his working environment (NE5, 1.1). The subjects he took exposed him to different modes of communication for different levels of staff. For example, he learnt that convincing and rallying the support of the shop floor and office staff requires different approaches. He believes that technical and conceptual skills are essential for all engineers working in any organization. However, engineering graduates generally need to work on improving their communication and collaborative skills. He acknowledges that writing skills are equally important as verbal skills for new engineers who aspire to climb the career ladder. Informant HRm also lamented students' weak communication skills during interview sessions and mentioned that:

“Students should be well versed in interpersonal and communication skills, it was clearly seen during interviews that students were lacking in interaction and struggle to communicate in English with the interviewers” (HRm, 1.3).

On the other hand, informant NE4 managed to vividly recall and appreciate all the hands-on training that he received at university (NE4, 1.1). The hands-on training was useful, relevant to his job and helped him increase his confidence to deal with employees at the production floor. Those courses gave him an in-depth understanding of the tools and equipment of the manufacturing process. However, he also lamented that the practical training was not sufficient as there are many more sophisticated process tools & equipment in the industry. Nevertheless, he managed to use his basic skills to self-learn and explore the more sophisticated tools in industry. Informant LEC4 also acknowledges the advantages of practical training and mentioned that:

“Besides the normal courses, we also emphasize on, hands on training such as welding, NDT (Non-Destructive Test) and basic handling of machines. We have very good workshops with well qualified instructors to handle practical trainings, as hands on experience would be very essential for students to apply at work place” (LEC4, 1.2).

From this analysis, we can deduce that new engineers generally remember subjects that are relevant to their current jobs. The promptness of their response is a good measure of how useful and relevant that subject is to their current job. Surprisingly, some of the candidates were unable to state more than two subjects, and some even took longer time to recall the basic subjects learnt at university. Some of them needed assistance from the researcher to answer the question. This observation can be used to infer that some engineering graduates invest their efforts at university for examinations per se.

Formal University Education Contributes to the Job Competency of New Engineers

The second theme addressed in this research was, “Formal university education contributes to the job competency of new engineers”. This question serves to evaluate whether university education has imparted the necessary competencies to new graduates. Engineering education must ensure that graduates acquire the technical and non-technical competencies required at the workplace. Sanghi (2004) stated that competencies are components of a job which are reflected in one’s behaviours in the workplace. Competency is the ability to perform a task to the level expected in employment.

Most engineers agree that their engineering degree was a ticket to secure a job, but it does not guarantee competency to carry out a task in the industry. The knowledge and skills gained from the university should be used to explore and learn new knowledge and skills at the industry. According to informant NE1, his university degree helped him to get a job and the technical subjects were more relevant to his job at the moment. He applied about 20 % of what he has learned in the university and the rest were for exam purpose only. The technical competency (manufacturing, maintenance, automation, quality and safety) that he acquired in the industry has helped him to do technical and planning work for production” (NE1, 3.3). On the other hand, informant HRm who laments the in-competencies of new graduates as some university students were unable to draw a simple electrical circuit during interview session. The department managers would be reluctant to employ someone who is not able to draw a simple electrical circuit, as there are more complicating circuits in the factory to be executed by new engineers. But generally, the diploma holders are better at hands-

on work than the degree holders. However, most lecturers believe that the hands-on training provided in the university is sufficient to handle basic manufacturing work in the industry. Informant LEC1 was confident that the technology workshop and practical lab training in his university was sufficed for the technical competency required by the industry. Informant LEC1 also reiterates that all the students have gone through mandatory practical training in university, but he doubts their application of the acquired skills upon graduation. Design of circuits are taught in the university for students and tested until they are competent in making the circuit to work, but he doubts, how much the students can remember once they are out from university (LEC1, 5.2). In fact, new engineers are lacking in job competencies and have to acquire most of the job-related competencies while working. New engineers can work independently or with minimum supervision if universities can educate students on job related competencies (SV2). Informant SV1 also suggests that, besides the technical competencies, new engineers must also acquire other basic competencies such as computer application, interpersonal and presentation skills.

From this analysis, it can be concluded that there is disagreement between the academia and the industry on the competency requirement. Both sides also seemed to be misinformed about the extent of competency required from new graduates. Based on the interviews-conducted, HRm claims that the new engineers lack basic practical knowledge of engineering circuits, diagram, systems and principles. Supervisors lament incapability of new engineers to understand the machine operating systems and concepts. One of the supervisors adds that new engineers should be able to demonstrate proficiency in communication and presentation skills. On the other hand, new engineers claim that only a small part of the knowledge gained during the course of their first degree end up being relevant to their jobs in the industry. However, lecturers are blaming the incompetency among new engineers on their inability to remember and apply their knowledge in the industry. Therefore, it is necessary to provide the new engineers the appropriate supplementary training to increase their level of competency as required in the industry:

1. Core Competency: common awareness across the organization such as International Standardization for Organization (ISO), Environmental Management System (EMS), and 5S concepts of Seiri, Seiton, Seiso, Seiketsu & Shitsuke and Safety.
2. Personal Competency: soft skills such as communication, problem solving, interpersonal, teamwork, planning and organizing.
3. Technical Competency: job functional skills such as knowledge of processes and equipment”.

DISCUSSION OF THE FINDINGS

Basic Knowledge and Skills Acquired at University

The first theme of this research is, “Basic knowledge and skills acquired at university”. These interview findings have been summarised, categorised into subthemes and related to relevant literature to check how useful and how well the new engineers remember the basic subjects they had learnt in university.

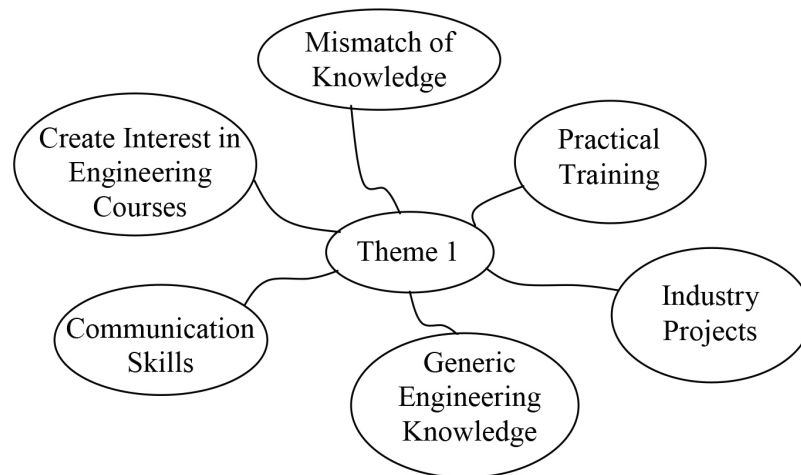


Figure 1: Subthemes of basic knowledge and skills acquired at university

Mismatch of Knowledge

Based on the interview findings, the most pertinent point that emerged was the mismatch of knowledge or the gap between learning and practice. For example, as mentioned by a new engineer (NE6) that “Statistics course in university was way too high level, theoretical and conceptual, but what was required at industry is very basic statistics that can be applied at shop-floor”. Concurred with past literature by Finley (2012), “A significant mismatch between Practitioners and Academics was that Practitioners were focused on outcomes while Academics were focused on the process itself”. Most of the new engineers felt that the courses at university were specific to engineering courses focusing on gauging student’s ability to do mathematics and engineering design and development. This was seen in the previous findings by Devine (2003), that, “Engineering curriculum is preparing engineers primarily for careers in research and development”. Many of the engineering graduates are employed in manufacturing industries rather than engineering firms doing pure engineering works. As such, most of their engineering knowledge will not be fully utilised in the manufacturing industry. Agreed in the past findings by Azami, Mohd Zaidi, Hasan, Norhamidi & Farah Liza (2009), “State of the current engineering education which does not emphasize on cooperation, knowledge retention, communication and the ability to synthesize and link courses and fields is a valid point of argument”. On the matter of graduate competencies, employers clearly imply that it is important to improve the engineering program, especially in a few non-technical aspects of the engineering education. Informants felt that engineering courses are unavoidable in the engineering faculty but the lacking of relevant manufacturing courses at university curriculum have made it difficult for new engineers to fit into the job right away. This is concurred by Devine (2003), that the “Engineers are therefore entering the workforce with little knowledge of manufacturing processes”. The lack of manufacturing knowledge among new engineers has required them to learn many new knowledge and skills at the beginning of their career in the manufacturing industry. They felt that, as most of their task requires them to learn many new things, the knowledge gained from university was not much of help. As such, the new engineers are unable to see the link between the knowledge gained at university and the knowledge required at the industry. That makes them think that there is no relevancy between university and industry. This fact is supported by past findings by

McConoughey (2008), which states that it was important to align a college's mission to create meaningful education experiences for students with the workplace's desire to have students who are prepared with job-ready skills. A similar issue was highlighted in another field of study by Ousey (2000), who described that there was an apparent gap between theory and practice in developed countries which was highlighted in the nursing care field. It has been stated that the term "gap" pointed towards the academics not being able to emphasise on the practical aspects.

Practical Training

The New Engineers have appreciated the hands-on practical training received at university. The hands-on training was useful, relevant to their job and helped them increase their confidence to deal with employees at the production floor. Those courses have given them an in-depth understanding of the tools and equipment of the manufacturing process. However, they also lamented that the practical training was not sufficient as there are many more sophisticated process tools & equipment in the industry. Nevertheless, they managed to use their basic skills to self-learn and explore the more sophisticated tools in industry. Concurred in the past findings by Mandal & Banerjee (2012), "To succeed in engineering profession, students must be strong in theory and practical hands-on experience". Some of the informants conveyed that the basic practical training lessons were sufficient and conducted by well-trained instructors. However, the past research highlighted on certain shortcomings in the lab exercises by Devine (2003), "When students do encounter problems during their lab exercises, the instructor often tells the student how to "fix it" without explaining the rationale for the solution".

Industry Projects

Lecturers have pointed out that the students are required to be involved in industry project work arranged by the university to work in groups with the intention of exposing them to real-life challenges in the industry and enhance team spirit among students. The importance of project based education has been expressed by Francis (2006), "Industry projects allow students the opportunity to apply their theoretical knowledge, usually design and build, and analyse products used in industries. By incorporating these

projects into their programs, many universities have found that the students' learning curve has been greatly improved. New engineers would appreciate the extra project arranged by university to impart real-life experience.

Generic Engineering Knowledge

The interview session with lecturers has implied that university is the best place to develop generic engineering knowledge and skills, build confidence and become an all-rounder. The knowledge and skills they obtain from classroom would generally be sufficient for them to perform basic jobs in the industry. What they are lacking is the in-depth knowledge and people skills that are required for them to progress in their career. The same issues have also prevailed among business studies graduates, and highlighted in the past findings by Hum, Abdul Aziz and Yohan (2013), "The common skill shortages of business graduates, especially in the field of business management were poor work attitude and foreign language, lacked in work experience, inadequate technical skill, communication skill, decision-making, analytical skill, and specialized skills". This sort of skills development has become a great challenge for curriculum designers to incorporate in university education curriculum. However, the HR manager felt that it is important for graduates to obtain knowledge beyond the lecture rooms besides excelling in academic pursuits. Besides the good academic knowledge, industries are looking for graduates who possess characteristics such as self-reliance, people skills, continuous improvement mentality and decision making skills. They want new graduates to have good analytical skills and are able to think critically. They also look for maturity, ability to articulate thoughts clearly and good reasoning methods. Similar suggestions were made in past findings by Walton and Austin (2001) that "Industry wants engineering students who can communicate well, show good teamwork, manage projects and understand the economic situation of their professional activities".

Communication Skills

New Engineers (NE2) mentioned that there were efforts by university to teach personal development skills especially the general English language course with substantial amount of time during the early stages at university. In fact, language and communication courses attended in the university have

refined the new engineer's communication skills and equipped him with the right tools to converse well which was reiterated by the interviewees. But how well the students master the subject will depend on how much they believe on the importance of this subject to survive in the corporate world, despite the strong emphasis by the university. Another New Engineer (NE5) felt that the communication subjects he took in university proved to be valuable because that has taught him skills to deal with different types of people in his current working environment. The subjects he learned exposed him to different modes of communication that can be applied to different levels of employees. He believes that technical and conceptual skills are essential for all engineers working in any organization but engineering graduates generally need to work on improving their communication and collaborative skills. He acknowledges that writing skills are equally important as verbal skills for new engineers who aspire to be successful in their career. Concurred by past research by Chan and Lee (2012) has also proven that "Those who graduated without profound communication skills have now come to realize the value of those skills and are of the opinion that Technical communication (which includes the ability to write reports) instruction has to be made compulsory in an undergraduate engineering course". The human resource manager (HRm) also lamented students' weak communication skills during interview sessions. They were unable to communicate in English fluently and at times not able to understand and provide an answer accurately. The New Engineers stated that there were extra-curricular activities at all universities done with the intention of improving teamwork, communication, problem solving skills and etc. The lecturers also affirmed that students were required to participate in these activities to fulfil curriculum requirements. It was observed that the students did not comprehend the actual objective of these activities and were unable to visualise how these activities could enhance personal development.

Create Interest in Engineering Course

Lecturers were disappointed that some of the students did not have the right aptitude for engineering courses. The sole purpose of study was to secure well paid jobs. Many of them took up engineering degree programs without knowing exactly what an engineering job is all about. This was supported by Lilley (1998) that, "For many young people, engineering is about mucky hands and car engines". Why does it appear to be that most

students who are studying engineering at university are only doing so because they are following in the footsteps of a relative? This is because the relative appears to be doing well in their profession and having a better lifestyle . . . Hence, it is essential that there should be proper screening done at the university on the quality of students at entry point. On the other hand, most of the new engineers have commented on the lecturing methodology being too theoretical. This was also seen in the past research by Devine (2003), “We cannot continue to design instruction around only learning theories that result in telling students what to remember and what to do and then punishing or rewarding them for their performance”. This common approach to instruction will get students to memorize things and perform certain tasks but it will not lead to conceptual understanding, will not help them think, nor enhance their ability to learn on their own.

Formal University Education Contributes to New Engineers’ Job Competency

The second theme of this research is, “Formal university education contributes to the job competency of new engineers”. These findings serve to evaluate whether university education has imparted the necessary competencies to new graduates to cope with the demands of their jobs.

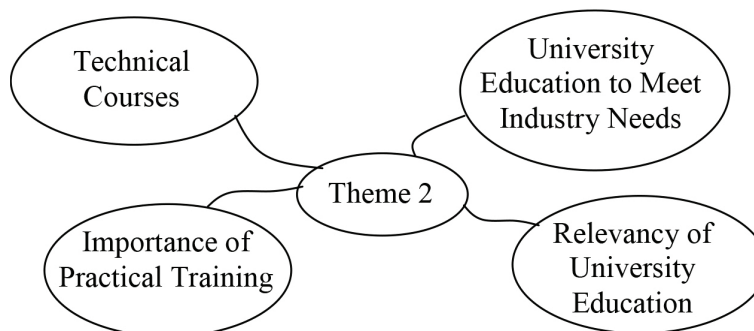


Figure 2: Subthemes of formal university education and new engineers’ job competency

University Education to Meet Industry Needs

Engineering education must ensure that graduates acquire the right technical and non-technical competencies required at the workplace. According to Rajah (2002), “There have been very few coordination efforts between technical institutes, schools and universities to propel education to meet the changing structure of demands by firms”. Findings of FICCI (2007), also highlighted the need for an understanding of the needs of the employer, requirements of specific skills by the industry and interaction of educational institutions with industry leaders. New engineer’s (NE2) concern is that the knowledge gained at university is not sufficient to make someone competent to work in the industry. Job competencies have to be acquired at workplace training and through work experience as they are very specific to the particular work environment. One of the supervisors (SV2) has also agreed that the new engineers are lacking in job competencies and have to acquire most of the job-related competencies while working. There are possibilities for new engineers to understand the job competencies faster if universities can instil industry related competencies for engineering students through their education curriculum. There were suggestions made in the past research by D’Agostino and O’Brien (2010) to improve university curriculum to help students to meet workplace competency. He suggested that there was a need to redesign curricula of higher educational institutions. The approach should be to enable students to interpret and apply their current methods of theory into the practical environment with emphasis on interaction approach. In fact, supervisors were disappointed on the inability of new engineers to understand the machine operating systems, concepts, proficiency in communication and presentation skills. According to new engineers, the degree of relevancy of knowledge gained from university will depend on the type of industry or job they are engaged. However, Lecturers are claiming that, students are not able to remember the knowledge acquired at university and use them effectively at the industry. Hence, it is necessary to provide appropriate supplementary trainings to cope with the competency required in the industry.

Relevancy of University Education to Industry

Mentioned by a new engineer (NE6) that the Statistics course in university was way too high level, theoretical and conceptual, but what was required at industry is very basic statistics that can be applied at shop-floor. The essential knowledge students must acquire is to analyse data, monitor trend and take action to prevent manufacturing process going out of track. Agreed in the past research by Francis (2006), “The greatest issue needing to be addressed in the education of manufacturing engineering students is their lack of understanding of manufacturing processes”. In industry, it has been stated many times that an engineer designed a part that looked good on print but could not be manufactured in reality. Some of the engineers have said that only a small portion of what they have learned at university is useful, especially the practical and project based courses and the rest was learned for examination. Most of the technical competency such as manufacturing, maintenance, automation, quality and safety had to be learned in industry while working. On the other hand, lecturer (LEC3) mentioned that the University syllabus covers more than what is required by the industry but it depends on the capability of the students to capitalize the knowledge and skills acquired at university. Students must be able to apply the acquired knowledge and skills at the workplace. Competency level depends on the commitment shown by the students at workplace.

Importance of Practical Training

Human Resource Manager raised concerns that some of the university students are unable to draw a simple electrical circuit during interview sessions. He wondered how students could handle more complicating circuits in the factory. Students should have some strong basic technical competencies otherwise it would be difficult to convince the department manager during interview session. Concurred in the past research by Devine (2003) he stated that students usually had to trouble shoot faulty circuits. During this process it was observed that the lecturers were required to instruct students on the steps of trouble shooting without them being made aware of the reason to follow these instructions. However, according to the Lecturer (LEC1), students have gone through mandatory practical training in university, but he doubts their application of the acquired skills after graduation. Design of circuits are taught in the university for students

and tested until they are competent in making the circuit to work, but he doubts, how much the students could remember once they were out from the university. The fact is, new engineers are required to use their basic technical knowledge gained in university and must be able to apply at industry appropriately. Devine (2003) in his work stated that professionals employed were required apply information learnt in the universities in various contexts in the industry, a skill called knowledge transfer, Unfortunately, the findings from Devine (2003) clearly indicates that students often have difficulty with knowledge transfer.

Technical Courses

Most lecturers were confident that the hands-on training provided in the university was sufficient to handle basic manufacturing work in the industry. They believed that the technology workshop and practical lab training in university sufficed for the technical competency required by the industry. Lecturers were aware that the new engineers were required to think quickly, analytically and carry-out designing tasks. Lecturers claimed that the curriculum at university was adequate to develop such skills in students. The past findings justify the reason by Reeves (2013), that “The well academically experienced professors will teach the students to fill them with plenty of knowledge and set coursework in order to meet the expectation of the curriculum”. New engineers agree that the knowledge and skills gained from the university should enable them to explore and learn new knowledge and skills easily at the industry. It should not only be a professional qualification to secure a job as agreed in the past research that graduating with a degree either local or abroad has become essential to secure a good job that comes with good salary (Rahmah, Ishak & Lai, 2011).

CONCLUSION

The findings imply that there is a mismatch between the knowledge taught to students and the knowledge expected by industry. Universities are educating students in mathematical subjects, applied science and engineering concepts but lack of emphasis on non-engineering subjects such as English language, computer and communication courses at university. University focused on students’ academic result to pass with good grades for the purpose of getting

good university ranking. Hence, it was observed that there was inadequate effort made to match university education to industry requirement. For universities to survive and prosper, they will have to continue their efforts to develop linkages with business and industry. Engineering programs must demonstrate that their graduates have the ability to function on multi-disciplinary teams to communicate effectively and a recognition for the need to engage in life-long learning. The skills that the industry want to see in graduating college students include communication, teamwork, leadership, and critical thinking skills. According to Tang (2014), “Although the liberal arts have been upheld as desirable or indispensable throughout the history of engineering education in America, until recently few scholars have sought to explore attempts to integrate engineers’ learning in the liberal arts with the techno-scientific disciplines. For a long time, most engineering educators were content with retaining the humanities and social sciences in a curriculum separate from math, sciences, and engineering sciences”. This means, the humanistic studies or liberal arts can develop an engineer to be more professional in his approach with people at work whereas, engineering skills will only make them proficient technically working with machines and engineering designs. In fact, both engineering and humanistic skills and knowledge are required for an engineer to be competent and progress in his career. The mismatch between employment and academic training can be as serious as the mismatch of skills between supply and demand in the workforce. As a result, when the linkage between the content of education and training in an academic degree program and the needs of industry is weak, private companies are forced to bear the burden and inefficiencies of providing separate programs of re-education and training.

Findings also imply that the Internship programs are not well organised to meet the actual objective of exposing students to real industry experience. Objectives cannot be achieved without the move by university to start collaboration with industry to enable students to gain appropriate industrial exposure. Internship coordinators need to stay abreast and find ways to improve the objective and execution of internship program. Students rely on internship tenure to see the connection between theory and practice. Internship programs that involve active partnerships among industry, universities and students rely on research to keep their internship programs current. The interaction of university coordinator and worksite supervisor with the interns during their internship may offer the intern better

recognition of both their personal and academic growth. It is only when all parties begin with the same vision that the goals and objectives become effective learning tools.

The study also implied that there is lack of industry exposure for lecturers. Tang (2014) has suggested that, “The department should put emphasis on hiring faculty with extensive professional experiences”. A good and experienced lecturer can guide students to make them to understand the lecture in a practical and simple manner. They can share their professional experience to students and the required attitudes and emotions deemed fit for their career. Francis (2006) also argued that, “The most crucial part of an educational program is the educator. An educator in the field of manufacturing engineering must possess an innovative spirit if the program is to be successful”. They must also have the knowledge and skill set to successfully interact with students to make their education a quality experience. Devine (2003) in his paper concurred that it was irrelevant to continue designing instructions focussed on learning theories. This would lead to students being punished or rewarded for their performance. The repercussion this action will be students memorizing things and perform tasks without any conceptual understanding. There would be no scope for original thoughts or enhancement in their learning capability.

Overall, the study implied that there is lacking university-industry collaboration. This study highlights several critical aspects that links university education and job performance; Students’ attitude, interpersonal skills and lack of manufacturing knowledge, lecturers’ level of industrial exposure, university-industry collaboration, disorganized internship programs and incompetent industry mentors were found to highly influence the ability of a new engineer to cope with job challenges. Therefore, both the university and industry need to work together to meet each other’s needs in order to reduce the knowledge gap and challenges faced by new engineers at workplace. Hence, McConoughey (2008) advocated that, “Industry/university partnerships should create the opportunity to develop curriculum that is relevant to the needs of industry and aligned with university programs”. Through partnerships, the universities would have insight into the most current business trends, research opportunities and regional career initiatives, and the university could enhance courses accordingly. The role of industry advisory boards are to advise university to

ascertain that the engineering curriculum is current, relevant and in line with the demands of the workplace. As a result, an effective advisory board will help to improve engineering curriculum, identify needs of manufacturing industry, supporting training programs, provide job placement, and provide professional development for lecturers to ensure better job competency of new engineers in the automotive industry.

REFERENCES

- Azami, Z., Mohd Zaidi, O., Hassan, B., Norhamidi, M. & Farah Liza, M.I. (2009). A gap study between employers' perception and expectation of engineering graduates in Malaysia. *WSEAS Transactions on Advances in Engineering Education*, 6(11), 409-419.
- Chan, Z.H. & Lee, C.P. (2012). Professional competency and the young engineer: Bridging the gap. *Jurutera: Young Engineers Section, IEM*, 8-13.
- Christodoulou, E. & Holmes, L. (2013). Mystar job.com. *The Star*, September 21, 2013, 6.
- Chua, Y.P. (2012). *Mastering research methods*. Kuala Lumpur: McGraw-Hill.
- D'Agostino, F. & O'Brien, M. (2010). *Closing the gap in curriculum leadership*, ALTC Final Report. Retrieved on 6 Sept, 2013 from <http://www.altc.edu.au/project-closing-gap-curriculum-uq-2006>
- Devine, K.L. (2003). *Using instructional design to improve knowledge transfer in manufacturing education*. Illinois State University.
- ICCI, Federation of Indian Chambers of Commerce & Industry, (2007). *Industry – academia convergence “bridging the skill gap”*, FICCI & NMIMS, Mumbai, India.
- Finlay, A. (2013). *Introduction to basic research methods, hand-out*, Multimedia Training Kit. Creative Commons Attribution-Share Alike License.

- Francis, M. (2006). *Integrating design and manufacturing into engineering education*. University of Alabama in Huntsville.
- Hum, C., Abdul Aziz, A.L. & Yohan, K. (2013). *Exploration of the gap between business management curriculum and employability requirements: A study of curriculum designers and recruiters' perceptions*, University Malaysia Kelantan.
- Keizrul, A. (2008). *Lembaga Jurutera Malaysia Board of Engineers Malaysia*. Retrieved March 14, 2017 from [https://www.bem.org.my/v3/body/pdf/einforeach/2008/BEM%20Sept08-Nov%2008%20\(Engineering%20Practice\).pdf](https://www.bem.org.my/v3/body/pdf/einforeach/2008/BEM%20Sept08-Nov%2008%20(Engineering%20Practice).pdf).
- Lautala, P.T. (2007). *Development of University-Industry Partnerships in Railroad Engineering Education*. Unpublished doctoral Thesis, Michigan Technological University.
- Lilley, A. (1998). Engineering through education. *Education & Training*, 40(2), 63 - 67.
- Mandal, K. & Banerjee, C.K. (2012). An empirical identification of performance gap in engineering education program from the perspective of stakeholders. *International Journal of Trade, Economics and Finance*, 3(4), 281-292.
- McConoughey, G. (2008). *Intern perceptions: How new college graduates in the workplace perceive their undergraduate internship experience*. Illinois State University.
- Neville, C. (2007). *Introduction to research and research methods*, University of Bradford School of Management UK.
- Ousey, K. (2000). Bridging the theory-practice gap? The role of the lecturer/practitioner in supporting pre-registration students gaining clinical experience in an orthopaedic unit. *Journal of Orthopaedic Nursing*, 4(3), 115-120.
- Rajah Rasiah (2002). *Systemic coordination and human capital development: knowledge flows in Malaysia's MNC-Driven Electronics Clusters*. The United Nations University, Institute for New Technologies.

- Rahmah, I., Ishak, Y. & Lai, W.S. (2011). Employers' perceptions on graduates in Malaysian services sector. *International Business Management*, 5(3), 184-193.
- Reeves, T. (2013). *Bridging the gap between university and industry: View points*. Retrieved 22 May, 2013 from <http://www.microsummits.org/sacramento/bridging-the-gap-between-university->
- Sanghi, S. (2004). Understanding, designing and implementing competency models in organizations. *The Handbook of Competency Mapping*. New Delhi: Sage Publications.
- Tang, X.F. (2014). *Engineering knowledge and student development: An institutional and pedagogical critique of engineering education*. UMI: ProQuest.
- Ukessays. (2013). *Analysis of the automotive industry in Malaysia*. Retrieved September, 2013 from <http://www.ukessays.com/essays/marketing/analysis-of-the-automotive-industry-in-malaysia-marketing-essay.php#ixzz2fg7Cch6N>
- Walton, M.A. & Austin, T.A. (2001). *The integrated civil engineering curriculum: The gap between the blackboard and business*, Iowa State University.