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Strategies for Development and Transfer of Practical Engineering Skills

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ABSTRACT

Practical delivery is an important concept in the field of Engineering towards tackling challenges being faced globally especially in the Industry. Imperatively, it has been observed there are many produced engineers who are not employable due to their insufficient practical knowledge in their chosen carrier; making them not to proper necessary solution to societal problem. Therefore it is highly required now to have a kind of synergy and leverages between the Industry and the Academia to acquire required technological skills in the field of engineering. However in every organization, Engineers should not be a problem provider but rather solution provider. This research thereby provides an eye openers on the need to adopt both Soft and Hard skills strategies in tackling Engineering practices menace.

Keywords: *Engineering, Hard Skills, Mentoring, Practical, Soft Skills*

INTRODUCTION

In the world of internationalized operations, the industry wants knowledge workers rather than mere subject experts for the 21st century workspace. Today, it does not suffice for an engineer to merely possess the technical knowledge, but requires a host of soft skills to make him/her more employment ready. Engineering education is screaming for a transformation. Mere transmission of subject knowledge of engineering is not going to help address the issue of employability of engineers. They require to be trained not only in their subjects, but also in terms of soft skills and life skills such as critical thinking, problem solving and communication proficiency. The reason for that is the industry is finding lesser number of employable engineers and a large number of engineers find themselves unemployed despite engineering credentials. This gap requires to be addressed in a way that benefits both the industry and engineers.

Engineering deals with solving of society's problems in a sustainable way and these problems to be solved are defined by the society, which also defines the acceptability of any prescribed solution (Falade, 2006). For engineers to achieve this they have to be equipped with the right technology and skills. Developing hard engineering skills which include computation, analysis and design can be achieved through both tuition and during work integrated learning. However, students require soft skills in addition to hard skills which enable them to effectively communicate and interact easily with others upon entering the real world of work. Work Integrated Learning can contribute towards the imparting of these soft skills. For this to be achieved the student has to be mentored effectively both by the institution and the industrial supervisor assigned to him during Work Integrated Learning. The mentor's guidance and the working environment assist the student to develop soft skills. In the past engineering education focused on imparting of hard or technical skills, which include technical or administrative procedures related to an organization's core business like machine operation and safety standards and procedures (Coates, 2006). However, increasing business complexity has shifted focus to coordination and communication; thus employers are putting more weight on soft skills (Firth, 2011). Globalization demands universities to produce engineers who can possess expert knowledge and think in terms of international, technical, social and financial relationships (Hopp, 2000) and equipped with skills to easily cross national and cultural.

TYPES OF SKILLS

There are two basic classifications of skills – Hard and Soft Skills. Hard and soft skills together constitute professional competence of an individual which allows a goal-oriented and situational accomplishment of working tasks (Kauffeld, Grote, & Frieling, 2003). In this review an attempt is made to distinguish between soft and hard skills.

Hard Skills

As soft skills can be regarded as knowledge gained at work based on interaction with colleagues (an interpersonal skills). However Hard Skills on the other hand are technical skills associated to a specific fields of interest. Hard skills are technical knowledge often gained through carrier, education or specific training. They include competencies like how to use a certain machine, software or another tool. Hard skills is an important parameter for people in the field of Engineering for an effective and efficient performance. Therefore for an Engineer to be relevant in the chosen carrier, both skills are very crucial.

Soft skills

Whitmore & Fry (1974) defined soft skills as important job-related skills that involve little or no interaction with machines and whose application on the job is quite generalized. Soft skills complement hard skills fulfill an important role in shaping an individual's (Schulz, 2007).

However, Soft skills include emotional intelligence, critical thinking, giving feedback and problem solving, report writing and presentation, project and team management.

A. Critical thinking

Critical thinking refers to higher order thinking that questions assumptions (Brookfield, 2000). It is an intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action (Scriven & Paul, 1987). Critical thinking is the mainstay of the most essential workplace skills, and is a strong attribute in people with good analysis and problem-solving skills, ability to learn

quickly, creativity and potential for career advancement (Chartrand et. al, 2009).

B. Emotional Intelligence

Emotional intelligence involves the accurate appraisal and expression of emotions in oneself and regulation in a way that enhances life by being able to consensually recognize emotional qualities of objects in the environment (Mayer et al., 1990). Poskey (2011) defined it as a set of competencies demonstrating the ability one has to recognize his or her behaviors, moods, and impulses, and to manage them best according to situation. Emotional intelligence can be grouped into three: personal competencies, social competencies and social skills.

C.   Effective report writing and Presentation skills

Presentation skills are becoming vital in the workplace (Cook, 2011). Soft skills like report writing develop in engineering students through project work (Pulko & Samir, 2003)

3.0 Importance of Soft Skills

Employers and educators have been complaining about a lack in soft skills among graduates from tertiary education institutions. The lack of soft skills seems to be serious in science and engineering programmes than in humanities since their programmes emphasize soft skills during the course of study (Schwanitz, 1999:482). Vonderheid (2002) observes that engineering students they realize they need soft skills like negotiation and communication when leave academia. He argues often people skills, management skills and personal characteristics overshadow conceptual and process skills as one climbs the corporate ladder and give them adaptability to work in other fields like purchasing which demand soft skills. Soft skills accounts for as much as 70% or individual performance, whereas cognitive ability and technical learning account for 30% (Hommrichhausen, 2002). More than 40 years ago the German Engineering Association (VDI) recommended that 20% of courses of the engineering curricula should be soft skills (Schulz, 2007). The past 10 years has seen engineering departments on a drive to equip students with basic professional skills and soft skills prior to graduation in order to satisfy needs of employers and professional organizations (Pulko & Samir, 2003).

3.1 Role of mentoring in impacting soft skills

Soft skills are either imparted through training or experiences and interactions (Baher, 2010). Del Vitto (2008) explains how soft skills can also be trained using an example of cultural diversity in global companies. It can be done through role playing and networking with experienced contemporaries who act as mentors (Baher, 2010). Starcevich (2009) characterizes mentoring as a power free, two-way mutually beneficial learning situation where the mentor provides advice, shares knowledge and experiences, and teaches using a low pressure, self-discovery approach. However it is important for the mentor to use a coaching approach to impart certain types of soft skills. Coaching is task related and enables learning and development to occur and thus performance to improve (Parsloe, 1999). Starting with sound diagnosis of the capabilities and attitudes, learning and development can occur provided there is specific, factual, and objective feedback.

3.2 Challenges to skills transfer during Work

•   Lack of suitably qualified and experienced mentors in industries where students are placed. Some supervisors don't understand the role of industrial engineering technologists and technicians. Many businesses offering work integrated learning are small to medium scale family enterprises with experienced in what they do but not appropriately qualified.

•   Lack of established training and mentorship practice is also a common problem in some companies especially Small to Medium scale Enterprises

•   Supervisors may not have time to adequately supervise trainees work due to high workloads

•   Lack of a proper performance monitoring and measurement system of trainees

4.0 STRATEGIES TO SOLVING THE PROBLEM

Industrial engineering technicians apply engineering theory and principles to problems of manufacturing layout or production, working under the supervision of engineers and technologists Trainees learn skills through observing other people around them, doing things, adopting what works best for them. In this discussion ways of how to impart soft skills to trainees are looked at in light of the observations and findings. Ways of improving soft skills through mentorship include looking at management style and commitment, appointment of the right mentor, structuring of the training, employing the right training method, and communication.

4.1 Choosing an Appropriate and qualified mentor

The mentors should be experienced with a minimum qualification (such as National Diploma). Due to large number of engineering students on the work program, a number of students find themselves in businesses and firms where industrial technologists are absent or services not employed. For example, industrial technologists are not employed in banks, they are rather hired or contracted for a particular assignment or task. A student who finds himself in such a place will hardly acquire any skills throughout the course of the program.

4.2 Well structuring of the training programmes

The structuring of Work Integrated Leaning programmes difficult for students who are already in jobs where they hold enormous responsibility making employers reluctant to rotate them to other sections as prescribed a training programme. The organization's policies on training can overcome these barriers. The mentor must facilitate the learning process either by challenging the student to solve assigned problems using industrial engineering tools taught in various prior course modules rather than do routine work throughout the training period. These assigned problems can be solved in the form of mini-projects with budget and targets. Project work assists students to develop project management and develop team skills

4.3 Identifying Supervisor's Coaching and mentoring roles

The mentor evaluates the student's needs, in order to identify the approach to mentoring required. A new trainee may have High Will and Low skill so the mentor must offer guidance and coaching. As the student training progresses there is a need to excite the student with new project challenges. Inappropriate training demoralizes students. The mentor may supervise the student himself or assign the duty of supervising the trainee to another competent section head for certain stages. During induction, the student needs initial motivation through a walk through the organization to stimulate their interest by the assigned supervisor so that they get to know each other. The supervisor must sell their credibility to the student.

4.4 Communication

Although modern technology has led to faster dissemination of information to a lot of people it has complicated the communication process for many. The widespread use of e-mail, the traditional chain of command is often not followed in communication patterns leading to conflicts. The challenge in

training is to allow trainees to use modern technologies without losing personal touch and be able to use verbal communication.

4.5 Teamwork and co-participation

The trainee must participate in teams during projects and delegation by the mentor ensures active co-participation. Team building depends on the organization's philosophy and the nature of the work. Interactive nature of teamwork builds communication skills, compromise and conflict resolution.

4.6 Problem Solving and Critical Thinking

Critical thinking refers to the ability to use knowledge, facts, and data to effectively solve workplace problems. A critical thinker may question why certain steps are taken to complete a task. The ability to develop a well thought out solution within a reasonable time frame.

5.0 CONCLUSION

Soft skills are critical in giving confidence, productivity and to unlock future potential in trainees. Training tasks should ensure there is a high level of soft skills imparted to complement hard skills they gain during the course of their training. However for an Engineer to be relevant in the chosen carrier, both soft and hard skills are very crucial.

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