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Emotional Intelligence in Engineering

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Abstract: Some of what engineers do in the workplace, such as working with others, communication, negotiating with clients, planning, decision-making etc., requires emotional intelligence (EI). Corporate downsizing, outsourcing, and globalization have dramatically changed the role of engineers. EI is a big factor for the 21st century engineers when making and sustaining relationships in the work place. Engineering programs must prepare students with the right kind of skills for the market place and society. This paper is intended to introduce skills and techniques on emotional intelligence to engineers.

Keywords: *Emotion, Emotional Intelligence, Emotional Intelligence For Engineers*

I. INTRODUCTION

Emotions are an integral part of mankind. Every emotion has a correlation to something in the human body. Emotions play an important role in critical thinking, learning, memory functions, decision making, etc. They contribute directly to rational thought and helps us interact with the surrounding environment. They are also associated with learning. It is a common belief that women are more emotional than men and this difference affects their career success. Several studies have confirmed this. Emotional intelligence is linked with human emotions.

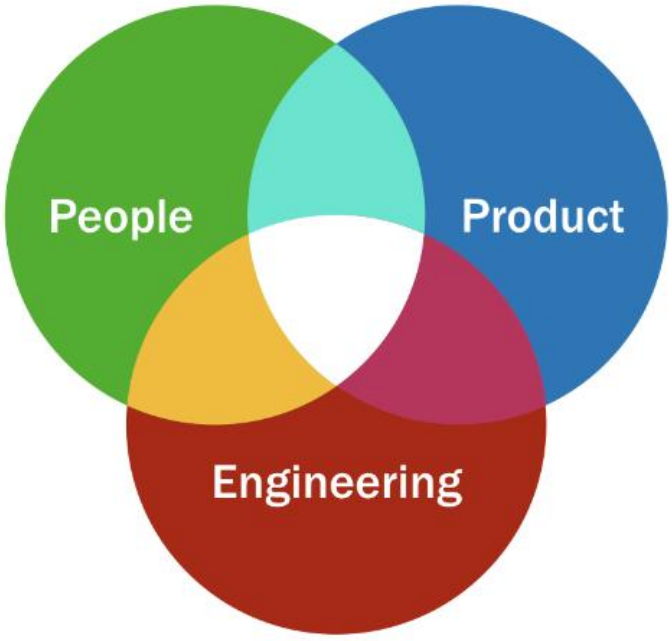

Figure 1: In technology, the three key focus areas are people, product and engineering [1].

Engineering is a profession that requires a high degree of intelligence, technical training, and creativity to succeed. As shown in Figure 1, in technology, the three key focus areas are people, product and engineering [1]. Engineering makes a huge impact on our health, financial areas, banking, mining, transport, and agriculture. Engineers contribute immensely to the advancement of the nation's economic growth. Their educational preparation gives them a good foundation in the application of creativity and innovation. However, engineering educators worldwide are realizing that engineering students need more skills with regard to learning. They need to prepare graduates, not just with engineering fundamentals, but also for success and improved skills to function effectively in the workplace, either domestic or global.

In view of the need for emotional competency, the Accreditation Board for Engineering and Technology (ABET) requires engineering programs to have documented student outcomes, including the following [2]:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. An ability to communicate effectively with a range of audiences
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

ABET has recognized communication skills as a key skill for engineers. An engineer is naturally expected to be strong in "hard skills" such as math skills, strong time management skills, problem solving skills, collaboration skills, and strong communication skills. Although engineers are perceived to have high IQ, it has been observed recently that IQ alone is no more the measure for success of engineers. To be successful and competitive in a continuously changing work environment, engineers need more than technical expertise. They are expected to possess interpersonal skills and be able to work efficiently in teams. Someone has said, "IQ gets you hired, but EQ gets you promoted" [2,3].

II. CONCEPT OF EMOTIONAL INTELLIGENCE

Intelligence quotient (IQ) is widely used as a measure of an individual's intellectual abilities. Emotional intelligence is equally important in defining communication competences and social interaction. It is a relatively new concept. Emotional intelligence (EI) or emotional quotient (EQ), may be regarded a mental ability that involves the ability to reason validly with

emotional information. It is a part of human personality. It is an effective way to distinguish potential high-performance workers. Emotional intelligence identifies certain natural skills and abilities that account for social competency. Figure 2 shows the essential 3-D global competencies for engineering graduate [4]

Figure 2: Essential 3-D global competencies for engineering graduate [4]

The education sector is responsible for preparing for the future workforce and leaders.

Its main objective is to educate in terms of acquiring capacities, competencies, and values. Emotional intelligence in academia highly impacts the learning process and cognitive intelligence of the students. Educators typically refer human behavior skills as "soft" or "non-technical skills." One element of soft skills is emotional intelligence. What distinguish the best engineers from the average engineers are the following emotional competencies [5]:

1. Strong achievement drive and high achievement standards
2. Ability to influence
3. Conceptual thinking
4. Analytical ability
5. Initiative in taking on new challenges
6. Self-confidence

These emotional competences can be divided into two categories: personal competences and social competences.

Emotional intelligence is pivotal to the success of every profession. It is important for training engineers, lawyers, nurses, doctors, pharmacists, architects, teachers, etc. EI has been noticed as the missing element in engineering curriculum [6]. Emotional intelligence is important for engineers and engineering students for a number of reasons [7]. First, the ability of engineers to understand their customers' needs and empathize with the end users are crucial for creating successful, user-friendly products and services. Secondly, engineers need people skills for communicating and delivering their tasks. Third, emotionally intelligent gives engineers the ability to be appreciate cultural differences and effectively operate within different cultural settings. Fourth, emotional intelligence distinguishes outstanding engineers from average engineers. Engineers with higher emotional intelligence take responsibility for the entire development process and prioritize their tasks themselves.

III. CHARATERISTICS OF EMOTIONAL INTELLIGENCE

Emotional intelligence is not related to IQ but is related personality measures. EI promotes understanding, better relationship, stability and harmony in human relationship.

These five elements that characterize emotional intelligence were suggested by Daniel Goleman, an American psychologist who gave emotional intelligence its global popularity

[8,9].

1. *Self-Awareness*: This is the ability to know your emotions, strengths, weaknesses, drives, and goals. Self-awareness involves realistic assessment of self-ability and self-confidence. It is something that can be made stronger over time with practice.
2. *Self-Regulation:* This is the ability to stay calm when emotions are running high. It includes qualities of self-control, ability to manage one`s own actions, to hold back impatience, and not to wait for immediate success.
3. *Motivation:* This constitutes emotional factors that help one reach their goals. Motivating oneself refers to driving one towards goal, to strive to improve and excel.
4. *Empathy:* Empathy (understanding others; listening well and reading nonverbal cues) is an important aspect in the student-teacher relationship. It is awareness of others' feelings, need,s and concerns.
5. *Social Skills*: These diverse skills are used to induce desirable responses in others. Social skills involve showing desirable emotions to others.

These five elements are illustrated in Figure 3 [10]. Individuals who exhibit high EI usually possess these five key elements. Daniel Goleman argues in his book that IQ contributes only about 20% to success in life, and other forces contribute the rest. Emotionally engineers are more likely to succeed in everything they undertake.

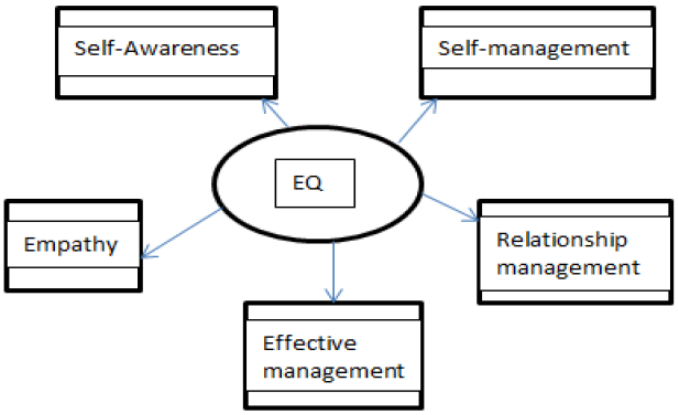

Figure 3: Five elements of emotional intelligence [10].

IV. BENEFITS AND CHALLENGES

EI has been found to help people adapt to new technology. EI helps you to relate better to your managers and co-workers and develop better working relationships with others. It will help an engineer to be more productive, more purpose-driven, and more satisfied in their work. Developing EIs kills is not only helps in achieving success in the workplace, it also helps develop happy, healthy, and balanced lives.

A major challenge that faces engineers is communication, the ability to convey ideas, work well in teams, influence others and build trust. Sometimes engineers are perceived as uncommunicative. EI makes a considerable impact on communication skills.

CONCLUSION

For engineers, success in the 21st century requires developing not only technical competencies but also emotional

intelligence. It's their diverse perspectives, unique ideas, and emotional intelligence that propel them forward and make them winners. When hiring, more and more companies are seeking student with skills such as communication, decision in making, problem solving, leadership, emotional intelligence, and social ethics. It is imperative that engineering students have the qualifications and competence modern companies are looking for.

Although the recognition of these competencies in engineering education is relatively new, educators have recognized the need to include them in the engineering curriculum. It has been predicted that engineering and other professions will move on to demand and develop EI skills in future graduates. There has been changes in engineering education, including the effort to improve the human behavior skills and capabilities of undergraduate students through an emotional intelligence course [11]. Emotional intelligence will now be one of those important capabilities for successful engineering practice.

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"I don't want to be at the mercy of my emotions. I want to use them, to enjoy them, and to dominate them"
- Oscar Wild