

Self-Confidence of Civil Engineering Students on Generic Skills and Attributes Vital for Engineering Industry

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Abstract -- A number of prior studies on engineering education has shown that engineering graduates nowadays are expected to be excellent in a wider range of skills and attributes such as communication, problem solving and management skills than the technical proficiency that was previously necessitated. This paper demonstrates the outcomes of a survey directed to the civil engineering students from Technological University (Myitkyina) with the objective of examining their confidence on generic attributes and skills that are vital in the dynamic and challenging world of engineering industry in the 21st century. Through this study, the students were able to reflect themselves, recognize their strengths and deficiencies and be prepared for the workplace.

Indexed Terms: Confidence Index, Civil Engineering Students, Skills and Attributes

I. INTRODUCTION

Technological universities are the main providers of engineering human resources for the engineering industry. There are a total of 22 Technological Universities all over Myanmar. This study was carried out in Technological University (Myitkyina) which is located in Myitkyina, the capital of the Kachin State. Currently, it offers four major disciplines: Civil Engineering, Electronic Communication Engineering, Electrical Power Engineering and Mechanical Power Engineering.

Civil engineering is a discipline that deals with planning, designing, and managing construction and maintenance of building structures, and facilities, such as roads, railroads, airports, bridges, harbors, channels, dams, irrigation projects, pipelines, power plants, and water and sewage systems that serve the general public[1].

Being a developing country, Myanmar is in need of skillful civil engineers to expand the nation's basic infrastructures. According to the definition of "civil engineering" stated above, it is obvious that the quality of a country's infrastructures depends on the

quality of its civil engineers as they are responsible for the managing, construction and conserving of those infrastructures.

Myanmar is in urgent needs to close its infrastructure gap, incorporate with the world and collaborate with its neighboring countries in order to gain from these initiatives for its economy growth [2]. This could bring more job opportunities for the Myanmar civil engineers as well as cause intense competition among local and foreign engineers such as Chinese, Japanese, and Korean. As for the Myanmar civil engineers to have competitive advantage in the domestic and international firms, it is important for both the civil engineering industry and education channels to cooperate hand in hand.

This study emphasized to assess the confidence of civil engineering students from Technological University (Myitkyina) concern with generic skills and attributes vital for the engineering industry. A number of prior studies on engineering education has shown that engineering graduates nowadays are expected to be excellent in a wider range of skills and attributes such as communication, problem solving and management skills than the technical proficiency that was previously necessitated. Those skills and attributes were compiled by Duyen Q. Nguyen in her 1998 paper: "The Essential Skills and Attributes of an Engineer: A Comparative Study of Academics, Industry Personnel and Engineering Students," which was carried out 20 years ago [3]. At that time, there were no widespread adoptions of Building Information Modeling. Big data, 3D printing, IOT, artificial intelligence and virtual reality technologies were only in the imagination of the Hollywood movie directors. Hence, there could be lacks of some sort of skills and attributes that would be crucial in this century. However, the most fundamental skills and attributes that can be shared among all engineering disciplines were displayed in her study [3].

II. LITERATURE REVIEW

Although it is a virtue to be competent in technical knowledge and skills as an engineer, morally good judgment is also vital in resolving engineering problems [4]. Competitive global market and altering work environment of 21st century call that engineers hold “soft skills” besides technical skills, and they must be able to comprehend project goals and have the ability to achieve them with obtainable resources [5].

In this time of intensified worldwide competition, leadership is a significant component in meeting the needs of the civil engineering profession. The civil engineering industry is calling upon educators to produce civil engineers who can lead multidisciplinary teams, merge technical ingenuity with business insight, and effectively communicate narrow engineering endeavors within a comprehensive social framework [6].

Technological universities would have to furnish the engineering students with a wider perspective of concepts in terms of environmental, economic, and social attributes, for decision making of sensitive to sustainability issues. Educational frameworks have to address a multifaceted analysis of sustainability [7].

Training of students to think critically about engineering problems and design projects is a vital learning objective. The issue of sustainable development displays numerous of the characteristics of ill-structured problems that entail critical thinking. Thus, the coalition of critical thinking education and sustainable development concepts delivers an essential contribution to the future education of civil engineering students [8].

Absence of employees with Building Information Modeling (BIM) skills is a noteworthy restraint delaying use of the technology in the engineering industry. BIM is worth to be integrated into undergraduate civil engineering curricula in a fundamental way so that graduate civil engineers will attain the skills and required to serve a construction industry in which three-dimensional models are the crucial for expression and communication of design intent and the basis for engineering analysis [9].

In improving its new engineering accreditation standards, ABET endorsed hard engineering skills with a set of six professional skills. Those skills consist of communication, cooperation, process skills, engineering within a global and societal context, lifelong learning, and awareness skills [10]. It should be also taught to engineering students how to be entrepreneurially minded so they can be key influencers in developing new products and services. This new pedagogical dimension must embrace not only instruction in the technical fundamentals of engineering, but also incorporate comprehension into the importance of customer awareness, an introduction to business principles, in addition to an emphasis on societal needs and values[11].

III. METHODOLOGY

A. Research Design

This study consists of five stages. The first stage covers literature review. Literatures on “the essential skills and attributes of an engineer” are revised. The second stage contains questionnaire design for assessing the civil engineering students. The third stage is surveying by questionnaires. The questionnaires are distributed to the civil engineering students in Technological University (Myitkyina). The fourth stage of this study consists of data collection from the respondents and data analysis. Firstly, collected data are analyzed by computing the central tendency. The last stage contains conclusion and recommendation.

B. Description of Questionnaire

The survey questionnaire was developed based upon the seven generic skills and attributes that are crucial in the engineering workplace as proposed by Duyen Q. Nguyen in her 1998 paper: “The Essential Skills and Attributes of an Engineer: A Comparative Study of Academic, Industry Personnel and Engineering Students [3].” The survey questionnaires were handed to the students and they were asked to grade themselves on each skill and attribute according to their confidence. The survey took place during their class in Technological University (Myitkyina) during the month of July, 2019.

Technical knowledge and skills comprises skills and attributes such as knowledge of science

fundamentals, engineering fundamentals and application, probability and statistics, computer science and technology and engineering practice.

The intellectual skills include logical thinking, problem-solving skills, communication skills, design skills, organizational, management and administrative skills and research skills.

Attitudes have been defined in the survey to include competence, integrity, commitment, tolerance, flexibility, commitment to lifelong learning, reliability, conscientiousness, punctuality and approachability.

Standards of engineering practice are defined to embrace measurement system, technical standards, specifications and inspection standards, testing practices, environmental constraints, code of ethics and proficiency standards.

Business practices consist of the following specialized skills and attributes such as free market economy, international marketplace, multinational corporations, international competitiveness, quality assurance, insurance, warranties and bidding procedures.

The international and national history and culture includes common history, national history and development cultural differences, economic and political issues, social life and customs, gender, religion and multiculturalism.

Proficiency in languages is defined to embrace spoken foreign language fluency, written foreign language fluency, regional dialects, technical terminology, and professional jargon [3].

C. Sampling Design

The studied population is the civil engineering students from Technological University (Myitkyina). The maximum possible samples were taken from each class.

D. Data Analysis Method

The confidence can vary from 0, the lowest to 10, the highest. The students have to grade themselves on each skills and attributes. In this paper, only the

results of the seven main attributes are shown. They are the mean scores of the average scores of each skills and attributes under them. The average scores were calculated in Microsoft Excel. Those outcomes are graphically shown under section IV.

IV. SURVEY RESULTS

Figure 4.1 demonstrates the confidence levels of first year civil engineering students on generic skills and attributes required to become competent engineering human resources for the engineering workplace. They show most confidence concern with attitudes and least with business practices. Their confidence on intellectual skills and technical knowledge and skills are significantly lesser compared to other classes.



Fig 4.1 Confidence index of first year civil engineering students on generic skills and attributes of an engineer

Figure 4.2 shows the confidence levels of second year civil engineering students. They manifest the highest degree of confidence with respect to attitudes and international/national history and culture. Their confidence levels for the rest of the skills become one step greater when compared with the first year students.



Fig 4.2 Confidence index of second year civil engineering students on generic skills and attributes of an engineer



Fig 4.4 Confidence index of fourth year civil engineering students on generic skills and attributes of an engineer

Figure 4.3 demonstrates the confidence levels of third year civil engineering students. They also display the maximum degree of confidence regarding attitudes which is followed by international/national history and culture.

The confidence index of fourth year civil engineering students can be seen in Figure 4.4. The utmost level of confidence goes to attitudes and international/national history and culture. Both third year and fourth year students show least confidence with regard to business practices. Fourth year students' confidence in intellectual skills is one step ahead than second and third year students and two steps to first year students.

Figure 4.5 and 4.6 shows the confidence index of fifth year and sixth year civil engineering students respectively. Both classes depict highest confidence in attitude and international/national history and culture. Neither of them shows a great confidence in understanding business practices.

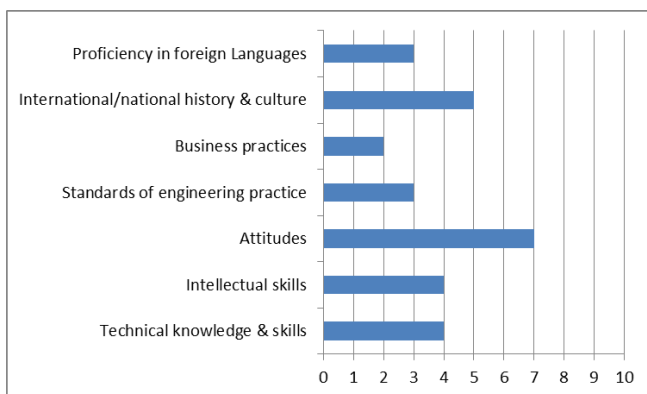


Fig 4.3 Confidence index of third year civil engineering students on generic skills and attributes of an engineer



Fig 4.5 Confidence index of fifth year civil engineering students on generic skills and attributes of an engineer

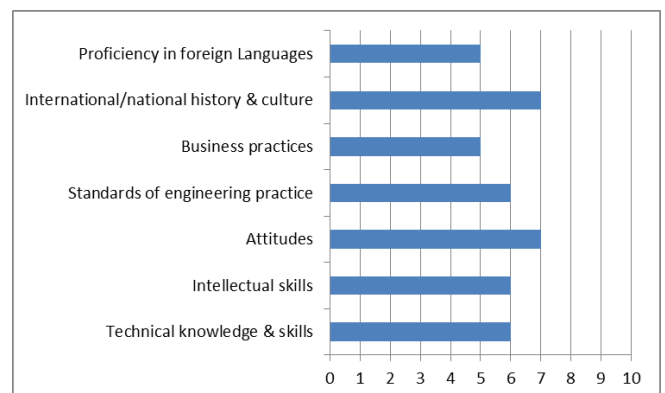


Fig 4.6 Confidence index of sixth year civil engineering students on generic skills and attributes of an engineer

Figure 4.7 shows Comparison of confidence levels among first, fourth and sixth year civil engineering students on generic skills and attributes of an engineer.

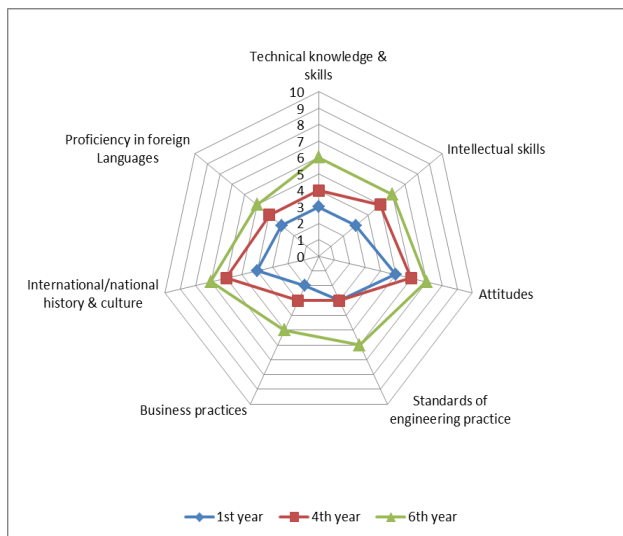


Fig 4.7 Comparison of confidence levels among first, fourth and sixth year civil engineering students on generic skills and attributes of an engineer

V. CONCLUSION

Study emphasizes to assess the confidence of civil engineering students from Technological University (Myitkyina) concern with generic skills and attributes crucial for the engineering workplace. It is obvious that students gain much confidence as they spend more time of studying.

This study can be advantageous by endorsing the civil engineering students to recognize the required skills and attributes for the engineering workplace and prepare in advance. It also highlights the deficiencies in current education system. However, it does not endeavor to manifest the strategies and methods to improve the current system. Further studies should be done to reveal ways and methods to enhance the system. In this way, the engineering

human resources can be developed in the long run for the advancement of the nation.

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