Professional Competency and the Young Engineer: Bridging the Gap


YOUNG ENGINEERS SECTION, IEM

by Ir. Chan Zhi Han and Engr. Lee Cheng Pay

GRADUATION – the beginning or the end? Beginning of a wonderful journey (equipped initially with an accredited degree, sound income-generating ability and an exclusive Institution's membership) which ends with having a privileged title before your name followed by a string of decorated characters to signify professional recognition.

Every saga has a beginning. Your graduation with an accredited engineering degree should be viewed as the beginning of a journey full of career fascination and endless rewards. As you are reading this, and if you feel that you are neither adequately appreciated nor sufficiently compensated, you are on the faultless route to self-improvement. Doran [1] believed that "… the formula for success in professional life is a mixture of ability and opportunity; a mixture of good luck and good health". Should we hypothetically assume that opportunity comes as Lady Luck smiles at you, what you need to do now is persistent pursuance of career excellence.

Reading this article could be part of *the* opportunity. According to a survey from the National Association of Colleges and Employers (U.S.), the top earners of the Class of 2011 were engineering graduates with a starting salary that increased 1.5% from the previous year. Computer engineering majors were the highest paid of the category [2]. Capitalising on your geographical advantage in the Asian region where developments take place at the speed of light, engineering graduates, like you, should be making your family and academia very proud.

THE PATH TO PROFESSIONAL COMPETENCY

Previous work [4] has given good coverage on the Malaysian engineering fraternity's requirement for practical training of graduates, the Professional Interview process and the Continuing Professional Development scheme to maintain one's Professional Engineer status. The first stage is the attainment of an accredited educational qualification, the graduate stage. The fundamental purpose of engineering education is to provide the knowledge base and attributes to enable the graduate to continue learning and to proceed to formative development that will provide the competencies required for independent practice. The second stage, following after a period of formative development, is professional registration. The fundamental purpose of formative development is to build on the educational base to develop the competencies required for independent practice in which the graduate works with engineering practitioners and progresses from an assisting role to taking more individual and team responsibility until competence can be demonstrated at the level required for registration. Once registered, the practitioner must maintain and expand his or her competencies [5]. The requirements are briefly described below.

1. Registration as a Graduate Engineer with Board of Engineers Malaysia (BEM) – A Graduate Engineer registered with in BEM has undergone and satisfied all the necessary curriculum of an accredited engineering programme.

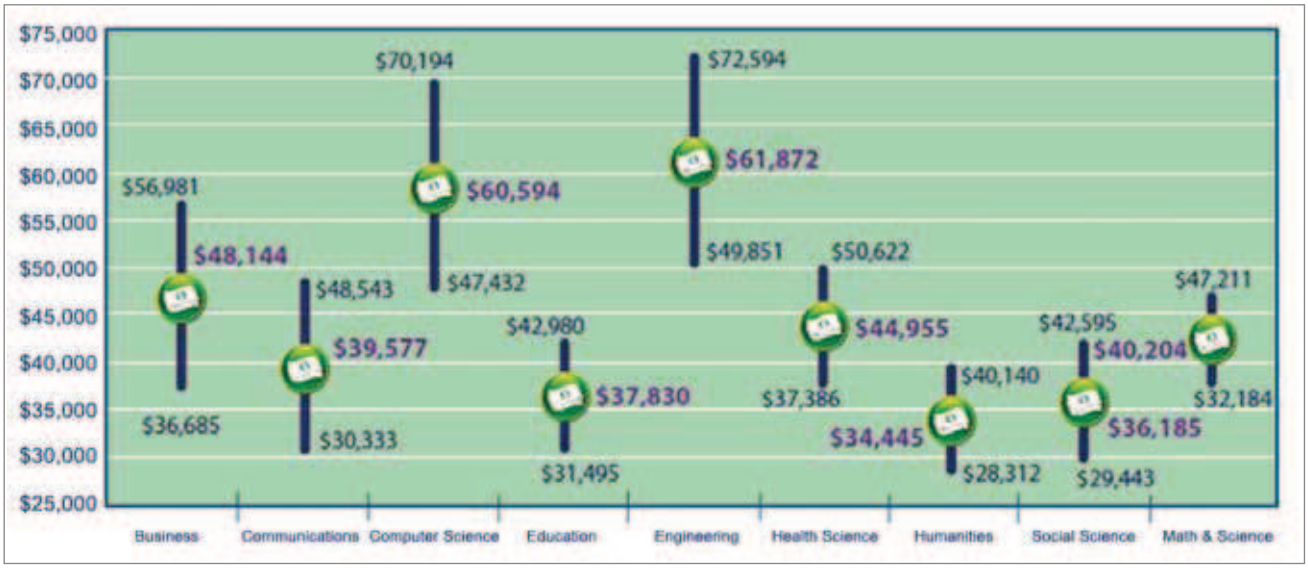

Figure 1: Starting salaries for new college graduates from the National Association of Colleges and Employers (NACE) salary survey in the United States of America [3]

(Continued on page 10)

2. Carry out practical experience in the planning, design, execution or management of such works as required within the profession of engineering for a period of at least three years. Depending on the discipline, both the quantitative and qualitative requirement of design and site experience must be duly satisfied. This can be done either via the Log Book Scheme or under the scrutiny of a Professional Engineer or a Corporate Member of IEM (or equivalent professional affiliation for the Supervising Engineers of international applicants).
3. Professional Development Points (PDP) – PDP is aimed to further improve and broaden the knowledge and skill of engineers in performing their duties in line with current practice and regulations.
4. Professional Interview – An all-rounded oral examination to assess the Graduate Engineer on his or her competency in technical design, site/field work, management, engineering application and in communication, as well as on maturity of thought, professional responsibility, ethical judgment and awareness of engineering sustainability, health and safety issues.
5. Essay writing on training and experience and code of ethics – A test of the Graduate Engineer's knowledge and ability to communicate in good English or Bahasa Malaysia, and to marshal his thoughts and then express them on paper in a clear, critical and concise manner.

Graduate Engineers are expected to achieve certain attributes by the industry. The industry expects young graduates to be well-trained academically and to be professionally competent in practice. After a few years in practice, it is not difficult to find that many graduates will have deflected from their original course of practising as an engineer. It is also not unusual to find these graduates reluctant to seek peer professional recognition, largely due to the misconception that the intent of the Professional Interview process is to fail them or give them grievance throughout the process.

As the rapid pace of the global community reflects the harshness of reality, the only constant is change. If young engineers are positively coached to see this phenomenon as an advantage they can exploit, any comments made by the appointed committee or authorized person throughout the various stages of the Professional Interview should be taken in the most constructive manner. As noted by Smith [6], we live in a changing world and who better to meet the challenges of change than fresh young engineers?

Engineers have by tradition been somewhat conservative and thereby slow to react to change, a fact noted by the late Ove Arup when he said:

You're right but that is what is wrong,
You stand still but life moves on,
To live is to change and not just to be,
If you can't then your youth is gone.

BRIDGING THE GAP – DESIGN AND EFFECTIVE COMMUNICATION

Einstein's life was in fact, to use his own words, "divided between politics and equations" [7]. This demonstrates how the science and engineering fraternity can heavily influence the history of a nation and the future of mankind. High impact research findings coupled with the necessary publicity seem to be the perfect ingredients to stardom. Although the days of I.K. Brunel where engineers enjoyed "celebrity" status are gone – who dare say the future engineers will not be envied in the same manner, if not better? The question of what engineers actually do and how young engineers can be trained has historically been of interest to both the academician and practicing engineers. Harris [8] thought that engineers were not good at problem solving. "They meet problems along the way and sometimes they need to solve them; at other times they change the problem so that it can more easily be solved or, better still, they dodge it".

The engineer's ability to ask the right question is just as important as knowing the answers. The engineer's greatest difficulty is to think of what he or she has not yet thought of. What was unforeseen can seem obvious with hindsight [9]. But engineering is about people, about their needs and abilities, their use of natural resources, and their interactions with one another. The mathematics and physics of the elements and forces in nature must relate to human behavior, willingness and resistance, wisdom and ignorance [10]. In pursuance of sound engineering design, we can now employ Finite Element Analysis or Computational Fluid Dynamics using technology that engineers of the 19th Century dared not to even dream of. Completed in 1890, The Forth Bridge that crosses the Fifth of Forth in the east of Scotland is *still* an engineering marvel, considering it was the first major structure in Britain to use Steel (not to be confused with Wrought Iron that the Eiffel Tower is built of). The engineers – Sir John Fowler and Sir Benjamin Baker adopted a human model to illustrate the rationale of the design (see Figure 2).

Figure 2: Innovative use of human model to illustrate the design of the Forth Bridge in Scotland

KEY FACTORS FOR SUCCESS

In order to be successful, a graduate engineer must be trained in the following areas [11]:

1. **Ethics and liability:** Because an engineer is expected to create a product that safeguards the life and welfare

(Continued on page 12)

of the public, this profession can have some painful legal penalties when negligence is proven. Engineers need to understand their responsibilities to the public, employers, clients, and their families, keeping ethical practice firmly embedded within the process of earning a living. As technical ability influences the course of a professional career, adherence to ethical practice will give it an air of satisfaction and peace of mind.

2. **Business knowledge:** All engineers need clients, ranging from the government funding research to a local homeowner with a dream to fulfill. Managing clients and business aspects, including scheduling, deadlines, and resource management, is not only a business owner's concern, but that of every employee who is instrumental in delivering a product. Those who begin a professional career will eventually come to the point where they can seriously consider becoming their own bosses through climbing the corporate ladder or building a business of their own; therefore a solid grounding in business skills will open the door to great possibilities.
3. **Communicating and delivering a product:** An engineer's work will be reviewed by an agency having the right to give or refuse a building permit. A building, for example, requires a set of structural calculations to prove that a particular design works and complies with adopted codes, notes, or specifications to indicate a desired outcome in the construction, and a set of drawings to show the complete assembly of the building from foundation and roof framing to the method of weather-protection. These documents must be organised, straightforward, and easy to follow through.
4. **Technical knowledge:** There will always be room to learn new things and to expand on existing knowledge related to the technical aspects of engineering including new technologies and discoveries, engineering code changes, new design standards, or design methods. Another important aspect to understand is material and assembly behavior, which can be understood through mechanical principles and research.

THE IMPORTANCE OF SOFT SKILLS

Those who left college without good communication skills now realise the importance of those skills – and think Technical Communication (inclusive of technical report writing ability) instruction should be mandatory [12] in engineering undergraduate course. Ability and the confidence to communicate is an aspect of paramount importance. Having the clarity of thought while communicating is definitely another string added to the bow. A competent engineer should be able to give his or her client a crisp and clear explanation even for specialist subjects. As a gesture to amplify the notion, a seasoned structural engineer drew a sketch (see Figure 3) to show his granddaughters how the present pylon design evolved and explained this in child-like terms.

Figure 3: Child-like explanation on the present design concept of a Pylon [13]

The significance of being a competent communicator is echoed by a Malaysian study [14]. The study focused on the discrepancy between what is expected of the work force and their performance as perceived by the employers according to thirteen competency attributes. 422 companies from six Malaysian industrial sectors were selected for the questionnaire study, and the measurement parameters used for the questionnaires were the mean gap. From the study, the "Ability to communicate effectively, not only with engineers but also with the community at large" and "Ability to undertake problem identification, formulation and solution" were given a top priority by all six industrial sectors in the process to find a better engineering workforce.

A graduate engineer might claim he or she is already communicating on a very active basis. With the growth of computing technology that can range from a deskbound call to a mobile internet application, it is not difficult to comprehend the importance that communication plays. But what constitutes to quality communication? If you find yourself to be breathless and wonder which issues are important and urgent from your e-mail, phone call and meeting that you will first need to address, let us try what Doran [15] suggests. "For one day a week, lock your office door, take the phone off the hook, sit behind your desk and think".

It is interesting that technical know-how is a strong point of at most four of the ten attributes defined in a study by Evans, Beakley, Crouch and Yamaguchi [16]. Although all customer groups ranked "Problem recognition and solution" to be first, there was considerable disagreement on the attributes that should fill positions two and three in a ranking of importance. The two faculty groups rated "Math and science skills" second and the task force faculty group rated "Depth and breadth of technical skills" to be third. But both the industry group and the alumni rated "Communication skills", "Professionalism and ethics" and "A responsible and open mind" above both "Depth and breadth of technical skills" and "Math and science skills". This is indicative of the mounting evidence that employers, especially those that are joining or that have joined the quality revolution, are desperate for people who do not have to learn on the job how to fit into a team-centered culture where communication, interpersonal skills, and professionalism, are as important as technical skills.

For a long time, society has averted itself from risk. Engineers are assumed to be those who have had the appropriate education and experience that qualify

themselves to provide protection to the public. The public expects engineers to protect them from unnecessary and undesirable risks, particularly those brought onto society through technological advancement and applications.

CONCLUDING REMARKS

The most positive attribute that Young Engineers can nurture is the completion of quality work within a predefined schedule. If it is true that, in future, time can be a commodity, let us save some and elaborate no further. As Cockshaw [17] puts it, "If you don't do a good job on time, you haven't got much chance of making a profit." At all times, be mindful that "Integrity is all [18]." ■

REFERENCES

[1] Doran D. (1999). "Introduction." in Doran D. "Eminent Civil Engineers: Their 20th Century Life and Times." Scotland: Whittles Publishing. 5.

[2] *http://finance.yahoo.com/news/college-graduates-score-higher-paying-201300743.html* Accessed 15 January 2012.

[3] National Association of Colleges and Employers (2012). "NACE Salary Survey. Starting Salaries for New College Graduates: January 2012 Executive Summary." Bethlehem: NACE.

[4] Lee, C. P. (Ed.) (2011). "Engineering Professionalism and Ethics." 5th Ed. Petaling Jaya: Young Engineers Section, The Institution of Engineers, Malaysia.

[5] International Engineering Alliance. Graduate Attributes and Professional Competencies Version 2 – 18 June 2009. *http://www.ieagreements.org*. Accessed 15 January 2012.

[6] Smith T. (1999). "The Changing Face of Engineering." in Doran D. "Eminent Civil Engineers: Their 20th Century Life and Times." Scotland: Whittles Publishing. 163.

[7] Hawking, S.W (1988). "A Brief History of Time: From the Big Bang to Black Holes". New York: Bantam Books. 187.

[8] Harris A. (1999). "How Engineers engineer." in Doran D. "Eminent Civil Engineers: Their 20th Century Life and Times." Scotland: Whittles Publishing. 25.

[9] Chapman J. (1999). "A Happy Life" in Doran D. "Eminent Civil Engineers: Their 20th Century Life and Times." Scotland: Whittles Publishing. 167.

[10] Armstrong J. H. (1999). "If you want God to smile tell Him your plans" in Doran D. "Eminent Civil Engineers: Their 20th Century Life and Times." Scotland: Whittles Publishing. 226.

[11] Adams D.K. (2008). "The Structural Engineer's Professional Training Manual" USA: McGraw-Hill Companies Inc. 11.

[12] Sageev P., Romanowski C.J. (2001). "A Message from Recent Engineering Graduates in the Workplace: Results of a Survey on Technical Communication Skills" Journal of Engineering Education. October 2001.

[13] The Institution of Structural Engineers (2011). "Verulam". The Structural Engineer 89 (22) 15 November 2011.

[14] Zaharim A., Omar M.Z., Basri H., Muhmad N., Mohd Isa F.L. "A Gap Study between Employers' Perception and Expectation of Engineering Graduates in Malaysia" WSEAS Transactions on Advances in Engineering Education. Issue 11, Volume 6, November 2009.

[15] Doran D. (1999). "Introduction." in Doran D. "Eminent Civil Engineers: Their 20th Century Life and Times." Scotland: Whittles Publishing. 4.

[16] Evans D.L., Beakley G.C., Crouch P.E. and Yamaguchi G.T. (1993). "Attributes of Engineering Graduates and Their Impact on Curriculum Design". Journal of Engineering Education, Vol. 82, No. 4, October 1993.

[17] Cockshaw A. (1999). "The Holistic Approach." in Doran D. "Eminent Civil Engineers: Their 20th Century Life and Times." Scotland: Whittles Publishing. 280.

[18] Flint A.R. (1999). "Some features of a career relevant to the future aims for a young engineer" in Doran D. "Eminent Civil Engineers: Their 20th Century Life and Times." Scotland: Whittles Publishing. 272.