

# Continuing Engineering Education through Lifelong Learning



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**CONTINUING** to learn is universally accepted and adopted by all professions. The rapid development in technology in this 21st Century requires a versatile and highly capable technical workforce. The engineering field is going through major changes at a very fast pace in its knowledge and applications. Thus, engineers need to update their knowledge and skills according to the technological changes which require them to adopt lifelong learning in order to achieve continuing education.

This article describes Continuing Engineering Education (CEE) via lifelong learning. Several issues are discussed with regard to CEE; the importance and challenges of CEE for engineers and the venues and tools that are available for knowledge expansion and skills development through lifelong learning.

## 1. INTRODUCTION

Lifelong learning (LLL) is the lifelong, life-wide, voluntary and self-motivated pursuit of knowledge for either personal or professional reasons (Venkata *et al.*, 2010). LLL is not only important for personal development but also for professional development where it could improve the competitiveness and employability of a person who is engaged with LLL. According to Wulf and Fisher (2002), the half-life of engineering knowledge is the time it takes for half of one's knowledge to become obsolete as the fast changes in technology could even make the knowledge one has acquired become obsolete in 2 to 8 years' time. Thus, lifelong learning is important in the engineering profession where it will help the engineers to keep up to date with current knowledge and skills which are essential to their profession. The European Commission has defined LLL (reported in Venkata *et al.*, 2010) as "all learning activity undertaken throughout life, with the aim of improved knowledge, skills and competence, within a personal, civic, social and/or employment related perspective".

For employers, encouraging and assisting lifelong learning in their organisations will help the employees to maintain their competitiveness locally and globally and also create a stable workforce. Thus, LLL is important for any engineering professional to be successful in his/her work and it needs good encouragement and support from employers in addition to dedication and commitments from the engineers. Continuing Engineering Education (CEE)

among the working engineers is growing through Continuing Professional Development (CPD) (Baukal, 2010).

CPD is defined as "the systematic maintenance and improvement of knowledge, skills and competence and the enhancement of learning, undertaken by an individual throughout his/her working life". CPD also could be defined in a simple way as "everything that you learn that makes you better able to do your job". In Malaysia, the number of CEE courses for working engineers is increasing where the courses are generally shorter in duration and focused more on competency and skills. Those courses that are targeted at specific professional applications are typically designed for fast learning and rapid adaptation. On the other hand, there are engineers who continue their studies to Masters or PhD level on a part time basis which is focused more on theoretical aspects while the duration is longer.

The main goal of CEE should be to ensure that there is an educated, skilled and energised workforce to meet the challenges of the 21st Century, and in order to achieve this, we need to build and sustain an appropriate infrastructure that can bolster the development of engineers.

## 2. CONTINUING ENGINEERING EDUCATION

Involvement in continuing engineering education, especially in continuing professional development to maintain a high quality practice, is widely identified as an implicit responsibility of professionals today, reinforced by explicit requirements of professional bodies (Friedman and Philips, 2004). CEE refers to specialised training taken by practising engineers who need both technical and non-technical knowledge as well as the relevant skills.

Working engineers participate actively in continuing engineering education nowadays due to the following reasons:

- The amount of continuing education opportunities offered by employers and by other providers is increasing.
- Professional institutions play an active role and are also important providers, with an increasing number of CPD programmes being offered.
- More universities are offering post-graduate degree programmes on a part time basis.
- CPD is being used to regulate professional practice.

## 2.1 Importance of Continuing Engineering Education

Many institutions have identified the importance of lifelong learning for engineers. The Board of Engineers Malaysia (BEM) and The Institution of Engineers, Malaysia (IEM) recommend CEE and encourage engineers to engage in CPD throughout their professional career to gain more knowledge and skills in both the technical and non-technical fields of study. At the same time, BEM has made it compulsory for engineers in Malaysia to gather CPD points to maintain their Professional Engineer (PE) licence.

The importance of CEE among engineers may be described as follows:

- a. Young engineers who have recently graduated need to get initial training in the particular discipline which they have just embarked into. Training is important for them to learn new technologies which they would need to apply in their jobs. On the other hand, experienced engineers may need training if they move to a new area of technology or field of engineering.
- b. Help engineers to keep up with advances in engineering, and non-technical training such as communication and presentation skills could help engineers improve their non-technical abilities.
- c. CEE helps engineers to maintain their PE registration. This registration is vital for many government departments and companies to certify that designs have been reviewed by a competent engineer.

The importance of CEE illustrated above underscores CEE as one of the most pivotal components for an engineer's development within his or her profession.

## 2.2 Challenges of Continuing Engineering Education

Engineering professionals are routinely confronted with complex problems that require them to be more analytical, innovative and critical, and to adopt reasoning skills in their decision making (Kaprawi *et al.*, 2008). Engineers are constantly confronted with new types of problems and new information about the existing problems; thus engineers must not stop equipping themselves with the latest knowledge and skills. This will require them to be more effective and efficient lifelong learners.

On the other hand, there are some challenges which are unique to CEE.

The challenges are as follows:

- a. Rapid changes in technology that make some of the information become obsolete very fast.
- b. Engineering education involves both theoretical and practical aspects whereby the educational service provider has to cater for both aspects to teach engineers the latest developments of the subject matter. However high costs could be incurred in providing the services since costly equipment for hands-on learning might be involved.
- c. New technology is being developed all around the world and due to globalisation, it is not sufficient to learn the technology advancements in one's own country. The engineers also need to be familiar with the latest developments around the globe.

These challenges indicate that there should be a strong collaboration among all the stakeholders in the engineering field to provide the required funding and expertise. The government, universities and industry must work hand in hand to provide the effective learning environment for engineers to gain more knowledge and skills on the advancements related to their engineering disciplines which indirectly contribute to the country's development.

## 3. CONTINUING ENGINEERING EDUCATION AVENUES AND TOOLS

Figure 1 shows various avenues that are available for CEE. These are described in further detail on page 16.



Figure 1: Avenues available for CEE (Venkata et al., 2010)

### Degrees

Postgraduate degree programmes – Masters and PhD are suitable for working engineers to gain mastery in focus areas. These programmes offered on a full time or part time basis depend on the students' availability. Basically, the Masters degree will take a maximum of about 2 years (full time) and 4 years (part time), while the PhD will take around 3 years for full time and up to 8 years for part time study. The fee for this programme is often borne by the students or their employers.

### Certificates

Certificate programmes are designed for practising engineers who prefer to get professional certification related to their field of work such as CCNA, CCNP, etc. Most certificate programmes are flexible and the delivery is made in real-time, online or a mix of the two. Many institutions including universities offer certificate programmes.

### Short Courses

Short courses offer an overview of the subject matter and may last for a few hours or up to a few days. Such courses

often involve active participation by the attendees and include both theoretical and practical aspects. In Malaysia, short courses are offered by IEM, universities and private training and education vendors.

### Tutorials

Tutorials help engineers to assimilate the information within a short duration of time, usually a day or less. Tutorials are usually delivered via talks, group discussions in a class, or even online. Typically, the topics discussed are narrow and the tutorials are offered to publicize the current outcome of a study. Tutorials are also offered as part of conferences.

### Conferences

Conferences are a good platform for lifelong learning. A conference includes various technical sessions where presentations on the findings of research activities are made, and also a keynote speech by a local or international guest speaker focusing on his or her viewpoints on the current developments within the specialised field of expertise. A conference is a platform to share and gain new knowledge among the engineers from all over the world.

### Webinars

A Webinar is an acronym for a Web-based Seminar. It takes place online where the participants can interact by submitting questions and discussing issues via a forum. Webinars are offered by different professional societies (IEEE, IMechE), universities and commercial vendors. Webinars are often archived with either free or controlled access.

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Figure 2: Tools for CEE (Venkata et al., 2010)

Figure 2 shows the tools that are available to assist the working engineers to engage with CEE online. Traditional learning can take place via classes, lectures, conferences, talks, and seminars. With the development of Information and Communication Technology (ICT), there are many new methods and tools which can be used for learning purposes utilising internet technology. These methods are more convenient and less costly compared to traditional ways. A lot of training, course and lecture materials are available through the internet, which allows engineers to gain knowledge and skills using the appropriate tools effectively. Web-based tools are widely available and can be used in the learning process. Therefore, engineers should take the opportunities and advantages offered by the internet.

## 4. CONCLUSION

Rapid technological advancements and globalisation are just a few of the many reasons that justify the need for CEE among engineers. The most important key objective of CEE is to ensure that engineers have sufficient knowledge and skills in their particular fields of work to enable them to keep up with the changes resulting from technological advancement. Government, employers, professional bodies and professional societies should encourage practising engineers to engage with lifelong learning so that no engineers would be left behind in this new era. Most importantly, the individual engineer must be responsible for finding CEE opportunities and options that are widely available to allow the engineer to retain and improve his or her professional competency. ■

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