

CONTINUING ENGINEERING EDUCATION - WHO NEEDS IT?

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Abstract

A review is given of the various actors who play a role in CEE. It is noted that the motives of these are varied and different. This makes the development of a coherent policy for the development of CPD/CEE difficult to frame, let alone develop and implement. This in its turn does not help its development

1. Introduction

Amongst practitioners there are inherent uncertainties and instabilities associated with CEE, which out of enthusiasm or commitment, it is all too easy to down play or overlook. Some of these issues and their impact are explored in this paper.

A debate continues about the nature, context and curricula of undergraduate engineering education. Amongst other influences this is driven by the rapid expansion in knowledge and changes in practices, concerns about attracting students into the engineering profession and the changing requirements of employers. However, these debates are frequently conducted without reference to a wider concept that a first degree should be just the start of a career-long education process.

There are several actors or stakeholders with interests in CPD activities, To how many university leaders is the provision of CEE important to their institute's mission? The response may not be flattering! Not all universities involved in engineering education have similar missions, priorities or profiles, but they should all be making appropriate contributions to CEE. Top university management frequently see CEE as ancillary to its mission and abhors the uncertain nature of such activities. However, there are many actions that could make CEE more central to the role of the universities, which should be developed.

Engineers bring diverse skill sets to the workforce and have been critical to the success of many businesses, both large and small. However, a common cry is of a lack of suitable engineers. There are potential solutions that might change such shortages, but some will take time to have an impact. The world is changing rapidly; the size of the professional engineering staff in many companies is declining, and the potential for lifetime employment within a company very much a feature of the last century. This influences the company's vision of long-term development of its engineers and hence more responsibility must rest with the individual engineer. Currently CEE structures do not necessarily recognise that in the future it may be the engineer himself paying. As practitioners it is incumbent to highlight these issues and engage with varied groups that influence their outcomes. If we fail to do so, should we complain if CEE is as it is? This paper will address some of these key issues.

2. Actors on the CEE stage

In this section is reflected on the various actors that have roles to play in CEE. This includes the engineers themselves, their employers, professional bodies and universities.

2.1 Engineers

Engineers are of course the focus of CEE activities, these are the professionals for whom principally the activity is aimed. Much is talked and even written about the obsolescence of knowledge, and that a degree has a limited 'shelf-life'. While it is widely appreciated that knowledge is increasing and engineering practices and techniques are evolving, a first degree is vitally important in laying the foundations. The emphasis of these foundations changes, but only over a much slower time scale. However what is quite clear is that while engineering knowledge increases and changes, an important part of initial formation is not only teaching young engineers the fundamentals, but also to think, to question and to express themselves as engineers. I would claim that this is essential and that initial education should be laying the foundations in the context that this will be followed by CEE, to meet their more specialist needs on a regular basis.

However not all engineers see it in this light. There can be an element amongst some of them that meeting the essential minimum is the target, hence if we are to raise the educational level of the profession it is vital to ensure that all mechanisms that encourage participation are explored and put in place.

2.2 Employers

Employers of engineers require a professional cadre which meets the needs of their business. For those that depend on engineers for their business it is essential that these engineers are 'up-to-date' with the latest techniques and practices, because it is this that will help maintain the engineering competence of the organisation. But employers, be they private companies, governmental organisations or NGOs (non-governmental organisations), all have budgets, a certain fraction of which will need to be allocated for CPD for the engineers of the company. How much is allocated varies from sector to sector, from company to company as a function of time. In addition, as education is essentially a net expenditure, which if budgets are tight can be reduced without immediate impact, this makes the continuing education of engineers subject to turbulence of the budget cycle. This contrasts with first cycle education where the individual does not immediately notice the effect of expenditure changes in the same way or in the same timescales. Thus what one might think idealistically as a company meeting its training needs and those of its engineers, becomes dependent on the vicissitudes of the financial position. From an educational standpoint this is unfortunate, although fully understandable, as ideally such development needs to continue irrespective of the economic position. It is also ironic that the quality of the education of the workforce, which is one of the issues that will help a company to re-orient or survive during periods of economic downturn, is one of the factors that an employer can easily forget. Another challenging feature of CEE is that during 'boom' times for a company there may be a reluctance to release staff because of the pressure on manpower to meet commitments. Conversely during stringent times it is claimed that staff cannot be released because of pressure on budgets. Clearly neither is an ideal situation. There are of course wider benefits to a company in terms of the development of its own contacts into the academic institution and a deepening or widening of its understanding of the institution's activities. It is most likely that these are already appreciated by the more enlightened or 'blue chip' companies, but these are not the only employers of engineers and it is with latter companies that such benefits need to be more strongly highlighted.

2.3 Professional Bodies

Most countries have one or more professional bodies that represent engineers. Their activities can take different forms, such as ensuring that there are standards of professional competence, codes of conduct which are adhered to by members, representing the profession

to government and trying to advance the status of engineers. This is just one facet of activities in addition to academic, information and publishing activities. Clearly it is in the interest of such professional bodies to ensure that professional standards are high and evolving to maintain the standing of the profession. An important facet of this must be to ensure that the education and competence of the professionals that the body represents is high and continues to develop. Membership usually requires specific admission standards and in this context the institution will take a very positive stance to CPD/CEE. This encouragement can take different forms in various bodies, from encouraging the maintenance of CPD logs to record the educational and developmental activities of individual members, to accrediting the suppliers of CPD/CEE activities for members. (In this context engineers tend to trail longer established professions such as law and medicine, which have been more advanced with the schemes they have for members to endorse provision and look to members to ensure that they have documented records of their activities.) Of course the role of professional bodies varies greatly between countries, but it is my personal view that professional bodies have a very important role to play in the development of CEE, and there might be benefits from a stronger relationship between professional bodies and academic institutions.

2.4 Universities

We like to think of universities as leaders in research, but we should not forget that they are not unique, that much quality research is done elsewhere and not all university work is from the very top draw. We also like to think that universities are experienced in education and the development of learning in others. Again while this is undoubtedly true, it does not necessarily mean they are either unique or necessarily the most suitable place for professional education or that they are the only place where professional might be educated.

It should be appreciated that universities are very pluralistic organisations and the various parts can have very different perceptions with respect to a specific activity. In regard to CEE this can manifest itself in various ways. The head of the institution may be supportive of the activity because in general terms it would seem to be appropriate and part of the institution's mission, but its profile will in all likelihood be very low, and understandably so, as much more significant and immediate issues both of policy and strategy demand attention. The director of finance will forever be struggling with conflicting demands of expenditure and income and will see the activity perhaps only for its potential for revenue generation. The director of CEE programmes, while wanting to encourage the development CEE activities, is likely to find more interest in activities from those wanting to know how to distribute any surpluses than those who are interested in contributing their generation. Faculty members will have diverse interests in CEE activities, ranging from none whatsoever to specific objectives of trying to generate income for themselves or their research. Not all faculty members appreciate how to teach effectively to professionals, because this can be somewhat different than the methods they use for undergraduate teaching. Heads of departments are probably interested in CEE from the perspective of income generation.

The foregoing analysis may seem a little cynical, but it does illustrate the problems in generating a balanced and customer oriented portfolio of activities from within an academic establishment with conflicting priorities and visions for the activity. There are advantages from CEE activities, but these are not always widely accepted. These activities are an additional way by which members of a university can widen their external contacts, perhaps in a way that otherwise might not have happened, with such activities being a two way process. There is evidence from CEE activities at Imperial College that a range of benefits can result. These have included consultancy opportunities, research contracts, even the stimulus for the development of a spin-out company. However, it is fascinating to note that despite this, projecting the

message of the opportunities and benefits is neither easy nor straightforward. It is vital, especially in an engineering field, that normal undergraduate and postgraduate teaching reflects the best of current practices. There is of course more than one way to facilitate this, but CEE can certainly be one way by which to gain access to such knowledge. This encourages the link between CEE and graduate teaching activities and helps prevent any form of isolation from society and working life.

One of the challenges for academic institutions is that with the continuing expansion of knowledge and developments in practice, decisions as to what is to be included in an engineering curriculum are always a challenge. Currently unfortunately the undergraduate curriculum is never seen in the perspective of laying the foundations for the more specific training that will be necessary later in professional life. The medical profession, where developments in treatments over the last 50 years have been impressive, and where treatment decisions can have far-reaching consequences, training is regarded as being much more integral with career development. It is not suggested by anyone that a graduate from a medical school is fully qualified professionally, quite the contrary it is expected that the training will continue throughout a professional life, taking different forms in a much more structured process. It would be a significant development if this concept were to become mirrored in undergraduate engineering education. After all the careers followed by any one cohort of graduating engineers are very diverse, so the education they will have received can in no way have equipped them all equally for the careers they will all eventually follow. Surely it is incumbent on all who are concerned with the development and delivery of CEE to spend time addressing these issues collectively for the long-term benefit of all.

2.4 Other Providers

Unlike the initial education and formation of professional engineers, in which universities tend to have a monopoly, when it comes to CPD/CEE this is not the case. There are many other providers, often with special orientations, such as for petroleum engineering, electronic circuit design and testing. In addition some professional institutions offer their own set of activities geared to members. In many of these instances the courses are presented by active faculty-based members, or retired industrially-based professionals, with specific expertise, who thus are in a strong position to relate academic knowledge to their own specific industrial experience. There can be direct competition between private and public providers in what is offered.

3. Challenges for CEE Development

In the previous section some of the issues that confront the development of CEE have been mentioned. It is hoped also that some of the conflicts that currently are inherent in its development and delivery have been identified. Many of those who are involved in such activities would be very happy if such activities were seen by academic institutions as being more central to their mission and more important to companies in their overall activities. How might this change?

Clearly nothing will stop companies being susceptible to the foibles of the market economy, but responsible companies will always comply with any legal requirements. Currently we are seeing companies having to operate within tighter fiscal reporting regimes and environmental constraints. Just as legislative controls that affect these are there partly to raise standards, it might well be the case that if accountability is further pursued, then the training records of professional engineers may need to be available. This may be encouraged by the increasing

litigious nature of society where corporate and individual liability is likely to be invoked more readily if anything goes awry.

It is suggested that if those involved in the provision of CEE are concerned about its effectiveness or status, they need to establish a wider consensus of opinion about the issues and common approaches to improving them. This perhaps is the greatest service that we can all make, by finding common cause, quality standards and information, to be more effective in raising the profile and importance of the activity.

Curriculum Vitae

Mervyn Jones

Mervyn Jones has degrees in Physics, Materials Science and Electrical Engineering, from Imperial College London and 25 years research experience in industry and university. He has been responsible for leading teams of scientists and engineers working on magnetic, opto-electronic, silicon/germanium heterostructure device development and electron beam lithography. Currently he is Director of the Centre for Professional Development at Imperial College London, where he is responsible for its professional development activities, extending across the full range of technical fields where the College is active. He is a director of a university spin-out company involved in natural resource evaluation software. He is a Fellow of the Institute of Physics, journal referee, an EC subject expert and currently is President of the International Association for Continuing Engineering Education (IACEE). He has published widely in both technical and educational areas.