

A work-based route to an engineering Msc and CEng for professional engineers working full time

Mr Mike Hope

Field Leader Work-based Learning
Kingston University
Faculty of Science, Engineering and Computing
London SW15 3DW
M.Hope@kingston.ac.uk

Dr Peter Barrington

Head of School
Kingston University
Faculty of Science, Engineering and Computing
London SW15 3DW
P.Barrington@kingston.ac.uk

Abstract

A case record is given of over 50 professional engineers undertaking a fully work-based engineering MSc, under the Engineering Council's "Engineering Gateways" scheme, whilst working full time. The scheme provides flexible learning off-campus for engineering practitioners, in collaboration with their employers. Academic learning and assessment are built around the projects they are undertaking at their workplace. The MSc assignments are also structured to demonstrate competence requirements for Chartered Engineer registration, CEng. Engineers seeking CEng need to demonstrate masters level learning to their Professional Engineering Institution. The paper presents an evaluation of factors influencing the successful progress of participants / students over the first 4 years of the "Gateways" scheme at Kingston University, London, the lead university for the scheme. The first participants started in late 2007 and the first graduates and Chartered Engineers from the Kingston scheme have been emerging since late 2010 and 2011 respectively. This work-based approach is increasing access to an MSc, and so to CEng registration, for engineers who would find it impracticable to study an MSc by other means. The flexibility, the relevance to their employment, the ability to continue working full time and the employer involvement (in content and funding) are cited by participants and employers as key positive factors for this work-based route to an MSc and CEng. For university staff, there is benefit from interaction with these engineers and their company mentors on current engineering projects, and from the opportunities to develop those relationships with industry.

Keywords

Work-based learning, engineering, MSc, CEng.

I. Introduction

The MSc Professional Engineering scheme was initiated under the Engineering Gateways programme, by collaboration between the Engineering Council, three Professional Engineering Institutions (PEIs), and four universities, of which Kingston University, London was the lead. The initial stage of the programme received funding from the UK government's then Department for Education and Science, DfES.

In 1997 the academic requirement for Chartered Engineer, CEng, was raised from bachelors to masters level learning. Engineers seeking registration as CEng also need to meet a set of professional competence standards, known as UK-SPEC, Engineering Council (2011). These standards are set by the Engineering Council, the UK registration body for the engineering profession, and are implemented by the PEIs.

Many professional engineers have bachelor level qualifications and so need a step up to masters level if they are to achieve CEng registration, which is a very common aspiration. Many universities offer MScs taught on campus, either full time or part time, the latter often combined with students' engineering work. However, many engineers with initial bachelor level qualifications find the subsequent achievement of an MSc a considerable barrier to their professional progression. For example, some find it financially or geographically impracticable to study for a relevant taught MSc at a university, even part time.

The MSc Professional Engineering (MSc Prof Eng), scheme is designed as an additional route to help potential Chartered Engineers to satisfy both the academic and the professional competence requirements for CEng, by work-based learning while still working full time.

The data for this paper were assembled by a combination of methods, notably one-to-one interviews with participants during 2010, feedback from supervisor sessions with participants and their managers/mentors, application forms, liaison by phone and email with those who withdrew from the scheme, an anonymous student survey in 2011 and interviews with the graduates. Information was also available from the Interim Report on the overall Gateways scheme, Engineering Council (2010), which covered all the universities then involved.

2. Basis of work-based model

Kingston University has over 12 years experience of work-based learning across several Faculties, with well established quality management processes operating under the university's Framework for Masters by Learning Agreement.

An underlying premise of this work-based scheme is that professional engineers working at or approaching CEng level will be undertaking activities that also involve masters level learning or provide springboard opportunities for it. We have found this to be valid. We have also found that engineers with more limited experience and working well below this CEng level or with a limited variety of work frequently have difficulty identifying sufficient work-based opportunities for masters level learning to satisfy our requirements.

The content of each person's MSc is set out in a formal Learning Agreement (LA). This is developed in the initial part of their programme, by liaison between the participant, their employer and the university, based on the activities and opportunities identified for that participant. The content of this is very flexible at Kingston as it is individually developed for each case. Modules are typically of 15 or 30 credit, plus a 60 credit dissertation / exit gateway, and with annual progression. The resulting LA has to satisfy the university's requirements for an MSc, and pass through our independent review and acceptance quality management process. In addition, the development of each MSc plan takes account of the professional development needs of that particular engineer at that time, with the aim of enabling them also to satisfy the UK-SPEC professional requirements for CEng. The latter will draw on their previous experience, and other work activities they are undertaking, in addition to the work for their MSc, but is specifically planned at the time of setting up each individual's LA.

The scheme at Kingston is fully work-based, and does not require attendance at the university campus, apart from a final viva. The university team hold periodic supervision sessions with each participant at their workplace, some of which include input from their line manager or mentor at work.

Acceptance by the professional engineering institutions operates under the Engineering Council's protocol for the Gateways scheme. That involves each person's MSc LA and CEng Competence Development Action Plan being considered by their PEI on an individual basis. Feedback from the PEI is either acceptance or a request for enhancement or clarification of certain aspects in the modules, so that appropriate revision can be made to the LA. All graduates still need to undertake the normal Chartered Professional Review for their PEI, as their final step to CEng.

3. MSc participants / students

Some data and characteristics on participants / students are as follows:

- A total of 55 engineers have embarked on this MSc Prof Eng scheme with Kingston. The first three started the pilot scheme in November 2007, the most recent in February 2012.
- In the period to February 2012:
 - 8 have graduated, 1 in 2010, 7 in 2011. Of these, 2 have already achieved CEng (reported by Engineering Council, 2012);
 - 26 are active;
 - 21 have withdrawn (38%). 17 (81%) of these had started in the early part of the pilot (Nov 2007 & 2008); 4 had started subsequently;
- the reasons for withdrawal, given or inferred, are (with % of those withdrawn):
 - 33% : made redundant or job change;
 - 19% : CEng by another route (e.g. new Royal Engineers route);
 - 19% : time for MSc on top of long work hours + family caused too much strain;
 - 10% : not suited to work-based learning approach;
 - 19% : not known;
- the graduates to date have taken between 2.5 and 3.5 years to complete;
- the age of participants is typically in the range 25 to 35 years, with some older and some younger;
- a large majority of the participants are funded by their employer, though some are not fully funded. A small number are self funded. The availability of this financial support from employers is judged to be a very positive factor in enabling participants to undertake the scheme. Some employers have been able to recover the fees from their Training Board.

The primary motivation for those embarking on the scheme is almost invariably as a route to the professional qualification, CEng; (data from application forms). This was confirmed in an anonymous survey of work-based students undertaken across all Faculties in 2011, with a 34% response rate of the 29 participants on this MSc Prof Eng scheme at that time, in which:

- 100% cited: “to progress in my current career path, i.e. for a professional qualification” (the route to CEng in this case);
- 50% also cited: “personal interest”;
- 30% also cited: “to improve employment prospects”.

In response to a question about the overall workload on the course, a large majority indicated they found it higher or much higher than they expected.

When asked about *learning experience on the course* responses were almost invariably: “Frequently”, or “Most of the time”, with a rare response (5%) of “Sometimes”. The questions were: “Thinking about your learning experience whilst on your course - to what extent have you:

- Been expected to analyse ideas or examine a particular case or situation in depth?
- Been expected to synthesise information or organise ideas or experiences into complex relationships?
- Been expected to judge and evaluate information, arguments, or methods?
- Been expected to apply theories to practice in new situations?”

4. Evaluation of the Kingston MSc Professional Engineering Scheme

4.1 Rate of progress

The rate of progress completing MSc module submissions is often slow initially, speeding up considerably towards completion, e.g. with the submissions for over 60% of the 180 credits required for the MSc being received in the last 12 months of study. A number of factors impeding progress were identified from this study, notably:

1. At work, many of these mature engineers were used to their reports being issued only after significant refinement and review by others, typically more senior.

2. Many participants found critical reflection and evaluation a challenging skill to develop.
3. There was a strong tendency to focus on the project details in their MSc reports, rather than on their personal learning, for which the project was the vehicle and context. At work they rarely mentioned themselves in reports and would never refer to their personal learning.
4. The participants had become unfamiliar with academic study and ways of working. For example:
 - a. Many were unfamiliar with academic techniques and assessment criteria or lacked attention to them.
 - b. Some felt uncertainty about requirements expressed in academic or generic language, which led to a disinclination to expend effort that might be wasted.
 - c. Some had a perception that very large amounts of work were needed for every module, and/or that an entire project needed to be covered in the submission document.
5. Many were experiencing high workload at work. This was sometimes exacerbated by companies' understandable caution about recruiting extra people when workload increased during this period of economic uncertainty, leading to additional "temporary" workload on existing staff. MSc projects were deferred to less pressured times.
6. That deferral appeared to be exacerbated by the very flexible approach to target submission dates then operating on our scheme.
7. Participants' engagement reduced markedly when away from their normal workplace, particularly if overseas, when face-to-face contact with our supervisors was not available.
8. Work projects take time to develop, so there was a tendency for a bunching of project outcomes, and the corresponding module submissions, in the latter part of the MSc.
9. Family change, such as the birth of an additional child, placed extra demands on time.

4.2 Flexibility

Feedback from participants and employers indicates that flexibility on timing and content is essential in these work-based schemes, for example to accommodate changes by a company's client to the *timing* of a work project on which the learning is based. Changes to the *LA content* are also needed sometimes, for example when an engineer changes company department, or a good new opportunity for masters level learning occurs, or a client cancels a project being used for a module.

Nevertheless flexibility has its downsides for both participants and the university. For example, it became apparent from the one-to-one interviews in 2010 that a greater emphasis on submission deadlines was needed. Accordingly a stepped sanction approach to submission dates was initiated, including, for example, notification to the employer if submissions are repeatedly deferred, whilst retaining necessary flexibility. It is noted that each participant's MSc content is effectively unique, with correspondingly low risk of one participant's work influencing that of another, regardless of submission dates.

From the university's perspective, the preparation of individual LAs is seen as helpful to participants and companies, but resource intensive. In addition, it often takes longer than is desirable to get the LA finalised and the participants fully underway. On top of this, though changes to the content of LAs occur in a minority of cases, these changes still need to be taken through the relevant quality management checks, which also takes time/resources.

4.3 Measures to enhance progress

The information on progress inhibitors enabled us to provide additional information and support targeted at those factors we could influence, to improve progress. These included the following:

1. Additional information and reminders, notably in supervisor sessions and feedback on drafts, helped improve participants' focus on reporting their learning and on the relevant assessment criteria for their submission. This also improved their understanding of the level of report refinement needed, clarified their understanding of the requirements and corrected false perceptions.
2. More guidance on critical reflection and evaluation was provided to help them get them started on it, and to augment the pointers to other sources of guidance on the topic.
3. The improved focus, clarity and guidance helped improve their confidence and make the tasks appear more manageable and less daunting.

4. Increasing the significance of the submission deadlines, as noted above, was subsequently reported by several participants to have improved their mental attitude and compliance.
5. Highlighting the potential risk of employer funding expiring after the target duration motivated some to accelerate, but not all.
6. Efforts to match expectations of time required to undertake the scheme to participants' subsequent experience are ongoing, but the time required for private study beyond work-based time does appear to vary considerably from one person to another.
7. New starters are involved more closely in the detailed development of their individual LA and its mapping of the modules to both the university's MSc characteristics and the UK-SPEC competences for CEng. This has increased understanding and ownership of the language used. Using the planning tools to focus their writing has also helped improve their focus.
8. Introduction of tracking *interim* progress of all modules at each supervisor session enables slow progress to be identified earlier, for appropriate action.
9. The introduction of web-based video calls with supervisors has improved participant engagement and progress when away overseas.
10. Identification of some projects with potential for early reporting has assisted early stage progress, reducing late stage bunching.

4.4 Employer engagement

Feedback received from the participants' employers and for the wider Gateways scheme, as in Seddon and Lock (2010) and Engineering Council (2010), conveys that the high relevance of the MSc modules to their type of work, the timing flexibility and their staff being able to continue working full time are some of the most positive factors for our MSc Prof Eng scheme. The benefit of their engineers learning new ways of approaching their work was also cited as a benefit.

Regular meetings with the mature engineer participants and their managers/mentors, typically senior technical figures in the companies, with the aim of helping their engineer become CEng, have led to some good relationships with engineering companies. For university staff, there is a clear and welcome benefit from interaction with these engineers on current engineering projects. The opportunities for development of the relationships are considerable, for example for collaborative research, additional students, student projects and placements, and participation in university industrial liaison boards.

5. Conclusion

We are continuing to develop ways to further streamline the development of the Learning Agreement and its issue to the relevant PEI, and to further enhance employer engagement.

The measures outlined here resulted in a threefold increase in the rate of progress, measured as the average credits achieved per student over a seven month period, compared to that previously achieved, normalised for the number of students and the period since they started - 'student months'. They also led to very positive feedback from many participants, and subsequently to 8 graduates, 2 of whom have already become CEng, with more in the pipeline.

6. References

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