Industrial dissertation for professional engineers

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Abstract

The Industrial Dissertation for Professional Engineers (IDPE) project is aimed at practicing engineers of any discipline who are not currently meeting qualification/training requirements that would enable them to achieve CEng status. IDPE works collaboratively with FE colleges, the North West Universities Association (NWUA), the North West Aerospace Alliance (NWAA), the North West Automotive Alliance (NWA Auto Alliance), COGENT, the Institute of Mechanical Engineers (IMechE), the Institute of Chemical Engineers (IChemE) and industrial partnerships and targets more than 200 North West (NW) regional employers. It provides an industrially-based dissertation (HE6/HE7) and extends outcomes from Higher Level Skills Pathway (HLSP) programmes. IDPE helps aspirational people seeking career progression and chartered status whilst they remain in their workplace to identify any of their relevant academic shortcomings and bridge key personal knowledge and skills gaps. Through IDPE, individuals enhance their knowledge and skills and experiential profile and gain 120 HE-level credits. Guidance is provided by an academic tutor and an industrial/employer mentor and support via e-learning and other materials.

Keywords: blended learning, Chartered Engineer, STEM, PDP, UK-SPEC, engineering

Background

The Industrial Dissertation for Professional Engineers (IDPE) enables non-graduate and graduate engineers operating at a professional level to undertake an industrially-based dissertation so as to enhance opportunities to become Chartered Engineers (CEng). This usually brings with it a mixture of professional opportunities, possibilities of promotion and increased pay and the status of being regarded as having professional standing and credibility. The IDPE dissertation involves the student proposing a technical topic that is relevant to their intended career. It may involve a project or area of work that the student could potentially be heavily involved in at their place of work or it may be an area that the student would like to move towards as part of their planned career path. On proposing the topic with academics and potential industrial mentors, the student then articulates the reasons for their choice has to justify (through the provision of appropriate evidence and documentation) the reasons for their proposal. A review of the proposal by academics and mentors then takes place and a decision taken about its technical, academic and logistical viability. Once approved, academic supervisors and mentors are then appointed to oversee, monitor and evaluate ongoing progress and eventual submission of the dissertation for assessment. IDPE focuses on approximately 15 students who would currently be seen as possessing graduate skills but who may not have a formal degree qualification. The background to the concept of IDPE partly arises from working collaboratively with employers and others in the North West (NW) to address shortfalls in specialist engineering skills (relating in the main to advanced composites) for more than five years (University of Bolton, 2010). During this period, many individuals have been identified who are qualified up to/near degree level but who do not have the educational/training background necessary for CEng status. Such individuals typically work within a company and often find it difficult to study for a postgraduate qualification due to employment or personal issues (Banks et al., 2011). IDPE is intended to assist this type of student by providing academic delivery in a blended learning environment, supported by academic tutors and industrial mentors. IDPE
builds on background research undertaken via the Higher Level Skills Pathway (HLSP) programme in Advanced Engineering Composites, mapped against UK-SPEC and the Institute of Mechanical Engineers (IMechE)’s Monitored Professional Development Scheme (MPDS), which enables individuals to generate a portfolio which facilitates a route to CEng. IDPE consists of 120 HE7 credits and meets the majority of outcomes normally associated with the MPDS which utilises learning achieved in the workplace via active learning sets and has support sessions from university academics and industrial mentors. Each student has an individual PDP embedded in their dissertation. This methodology is based on recent work done with IMechE in conjunction with Aircelle Aerospace Ltd at Burnley.

Rationale

IDPE is provided at postgraduate level and its purpose is to develop professional engineers in terms of both academic endeavour and relevant skills, as detailed in the UK-SPEC and IMechE publication Meeting the Challenges and Demands and Supply of Engineers in the UK (2011). The programme is aimed at graduate engineers or those that have gained many years’ experience at this level or above. The initial learning is geared towards setting up students’ research and personal skills by guiding them through an e-learning environment. The university uses the web-based teaching aid/repository MOODLE to drive this activity. For the IDPE project, this process is currently due to finish by late February 2012, after which the students will aim to develop their e-PDP based on UK-SPEC. In conjunction with this, the students will also study a technical module which will enable them to carry out the research element of their dissertation. The benefit of this process will be that the students become more self-directed and independent learners. The e-PDP will guide the students through their dissertation and enable them to map against the requirements of UK-SPEC.

The approach to learning for groups such as IDPE students is one of student-centred learning which consists of elements such as enquiry-based learning, reflective learning, learning how to learn and some didactic teaching. The University of Bolton is renowned for actively engaging disadvantaged groups and IDPE further assists in that endeavour. IDPE is also, in part, a response to the objectives shared with The Royal Academy of Engineering and identified in its Strategic Plan 2005-2010. The intended outcome of the approach taken through the IDPE methodology is that students will recognise that they may need to learn how to learn, identify areas of knowledge and skills in which they need to develop and make plans for how they are going to proceed through the programme and on to a professional engineering-based career whilst continuing to develop themselves as adult learners. Amongst the intended outcomes are that people recognise the value of becoming lifelong learners and develop the capacity to consider applications for employment in all branches of engineering at a professional level. This philosophy is also supported by the professional bodies for applicants wishing to follow membership as an individual rather than via the traditional route.

The approach

IDPE consists of a small number of students (approximately 15) undertaking a number of modules in engineering, technology and computer skills, producing a Personal Development Plan (PDP) and receiving career counselling and guidance where appropriate. Monitoring and evaluation of IDPE is largely provided through university procedures and specific project management. Promotion and dissemination of IDPE are intended to be undertaken collaboratively. The students are interviewed at the outset of the project with a view to ascertaining their strengths and weaknesses. Those who successfully complete IDPE will either be awarded an Advanced Diploma in Professional Development or, for those with sufficient funds, continue on to a MSc programme. After consultation that involved visits to manufacturers such as Aircelle and Walker Seals, participation in employer fora such as the North West Aerospace Alliance (NWAA), SEMTA and the IMechE and discussion with representatives from industry and associated agencies about issues such as relevant content, assessment delivery and timing of the programme an overall
approach for the IDPE project was agreed in principle. The input from these fora involved consideration and discussion of elements such as timing and duration, flexibility of participation, cost, supervision, content and relevance of individual IDPE outcomes in relation to stated and/or anticipated organisational goals. Of primary concern to industrialists appeared to be issues of technical and business relevance, cost and flexibility. Fortunately IDPE was able to address these concerns. Issues that were more difficult to resolve included personal and professional reward on successful completion and future opportunities that might arise. The approach used by the IDPE project (which was to initially interview each potential participant) was based not just on the applicant’s technical ability but also on their personal motivation and their potential for working as part of a team at a professional level. The interview process indicated that some potential students lacked personal and professional qualities and attributes, a problem that, if left unaddressed, may hold them back in their careers. IDPE is intended to identify this situation and provide appropriate means of improvement.

The initial activity ranges from some engineering/technical information to related technical and professional writing. The students are immersed in an engineering topic agreed with the tutor and guided towards producing a technically-based academic paper as a simulation of the actual process for peer review and publication. This approach also gives them the skills needed to review their technical communications and reflect on their writing. After completing this task, the students are asked to give a short presentation on their paper to a technical audience of mixed disciplines.

Assessment

IDPE students are assessed throughout the project via presentations and coursework to a small team. This method moves away from the traditional examination system used in engineering education so as to try to reflect an actual working environment. This process appears to be much appreciated by the mature students that IDPE naturally attracts, particularly as it seems to help those returning to education after a lengthy period. Performance outcomes will be known by late February 2012; however, early indications appear to support this approach.

Assessment of the dissertation, when the project is conducted in industry or the workplace, needs careful management. The process involves using chartered engineers (and/or mentors) within a company wherever possible. These designated individuals verify that the student has completed the work themselves. The mentors give an initial assessment and level indication of the work. This is then marked by the academic tutor(s) involved. When disagreement occurs a third person must be involved. The final grade, however, is subject to an interview assessment viva. This method of assessment appeared to be favoured by most companies that were consulted. Some reasons for the dissertation process (including assessment) seeming popular with employers includes the potential for discussion, participation and involvement in academic projects that are related to the workplace and of likely relevance to the mentor(s), an opportunity to understand an academic process, the possibility that a representative from industry may have some influence on assessment criteria and how they might be applied and also the potential for representatives to gain more understanding of how engineering employers could become more involved in collaborative ventures with the academic sector.

Evaluation

The evaluation process is ongoing, due to the fact that students only commenced their studies in the summer of 2011 and are consequently only part-way through their study programme. IDPE had to go through the university validation process which took longer than first anticipated due to the organisational restructuring programme being undertaken by the university. Irrespective of their background, a small group of students (representing 75% of the recruitment target originally intended) have started their programme and have been monitored regularly. Certain trends/traits have been highlighted. IDPE has been successful in recruiting students of the intended calibre and has therefore addressed access and flexibility issues of the target group. Some unforeseen issues have arisen whilst undertaking the IDPE project, but these have largely been outside of the control of the project team. One issue was the downsizing of company workforces (due to Governmental contractual obligations being significantly reduced) which restricted recruitment of elements of the
target group. Another issue included the ongoing restructuring of the host university which has directly impacted the operational capacity of the project staff; the management team of the faculty has changed in several ways, including identity, role, capability and, arguably, levels of commitment.

From interview data, it is apparent that many IDPE students are short on specific non-technical skills which we have initially termed ‘X-factors’. The students all appear to have good technical knowledge but are not necessarily what might be described as ‘rounded individuals’. Due to this apparent deficiency it is recognised that they may struggle at stages of their career that might require or involve prolonged interviews. The emergence of the ‘X-factors’ had not originally been anticipated as a consideration; however, the process adopted and used by IDPE should now help the students to make progress in their future careers.

In order to address this deficiency, the ‘X factor’ elements have now been included in the new version of the e-PDP. This is also being considered for the new validation of the faculty’s MEng programme in March 2012.

Quite often, the main difficulty for the students appears to be a financial one. Many who intended to start the programme either studied only a part of it or wanted to defer the start in order to restructure their personal finances. To militate against this, the IDPE programme has now been split into sections so that the cost can be distributed over a longer period. However, this approach has necessitated extending the period of study, although this is not as detrimental as one might imagine as many of the students have long term aspirations to become Chartered Engineers and are expecting to undertake a journey of some length.

Even though for many students the process is taking longer than first anticipated, they appear to be happy in general with their programme. One student said: “I wish we had this system when I did my degree”, referring to notes and material he was able to access through MOODLE and the academic and counselling support he received generally.

Discussion, summary

The use of online support for the students has helped their development since it was provided with the help of tutors and not just a sole aid to learning. It was very useful on an individual basis as it helped them to reflect and focus at the beginning of their study programme.

It certainly would have helped if we had had more time to speak to companies on a one-to-one basis; however, due to cost and time constraints this was not always possible. Working with companies on an individual basis really helped them to gain an understanding of what we were trying to achieve.

Our approach to teaching and learning, and to the project generally, appears to be welcomed by the students with whom we have worked. Mature returners in particular need more initial support than recent (within the last three years) graduates; however, once they have gained this confidence they can bring greater industrial experience to the educational process which helps students and tutors and enhances the project generally.

At the time of writing, the IDPE is approaching the end of the first assessment period (February) and this should indicate the strength of our initial perceptions and assumptions. The initial small group of five students, plus another three, should help us to make a comparison with the performance of our mainstream students.

Further development

The IDPE project raises some very interesting questions about the profile of students who participated and those who did not which could lead to further research and study.

For those people who participated in the project, questions need to be considered, such as are their needs for the missing ‘X-factors’ to be addressed as part of a wider debate about potential deficiencies in the education and training of professional engineers? And, if so, where should that debate occur? Who should be involved in that debate, what actions should be taken and how
should these actions be implemented? And how long would it be before these actions would show measurable outcomes?

Amongst those who did not participate in IDPE, it was interesting to note that the profile of respondents to the IDPE project did not include any women. This may be due to various factors, including the shortage of women in engineering generally, but it could also be related to issues such as the approach that women take to responding to changes and challenges that arise in their professional or personal lives. Of course, there may be other reasons to do with channels of publicity, subtleties of promotional messages, etc., and any combination of the aforementioned but, whatever the reasons, more detailed analysis needs to be undertaken. We took great care in trying to promote the IDPE and two female members of the faculty staff who contributed to the programme delivery were also unclear as to why no females enquired about it.

Questions have arisen about the use of mentors and the appropriateness of the viva approach and whether it should be used for all of our assessments. The project team is considering setting up an academic and industry relations board to discuss this process for future assessments in general. At present, we as a project team would also like to encourage this method in some of our new technical masters’ programmes that are currently being revalidated. We would like to promote this method to industry and the professional bodies as we feel that this approach gives the team greater flexibility in assessing the students’ actual knowledge and ability. There is also less chance of plagiarism or collusion in the workplace.

These and other similar questions prompt further discussion/research about how to classify, qualify and quantify the ‘X-factors’, identify evidence which would demonstrate their absence in potential professional engineers and find out whether people are generally capable of managing them well so as to address them without actually diluting their engineering specialism.

The work done on this programme will be incorporated by the University of Bolton in its new engineering programme to be validated in March 2012. The e-PDP and the technical publications are to be subsumed by the new postgraduate programmes and it is also anticipated that the process will be incorporated in the new CPD programmes aimed at the graduate engineer market currently under discussion with the ANSYS® CPD team.

The team is also looking at linking the PDP with the university’s social network, as well as international ones. There are currently software conflicts in this area, but we hope to overcome these problems in the near future with new upgrades.

The university will also incorporate the programme in its new pan-university CPD programmes aimed at the postgraduate market for delivery in 2012.

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Further reading/bibliography
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