

A Matter of Professionalism? Reflection & Reflexivity in Continuing Engineering Education & Practice

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ABSTRACT

The argument that this paper sets out to critique is that in order to promote professionalism in Engineering Education and Practice, graduate level engineering programmes need to introduce the concepts of reflection and reflexivity into the curriculum right from the onset. By focusing upon the delivery of a newly developed 'Work Based' Master's level programme in Professional Engineering, this paper provides an overview of the first part of an empirical study which sets out to investigate the challenges associated with embedding reflection and reflexivity into Engineering Education. The paper concludes by noting that whilst student engineers may struggle with the concepts of reflection and reflexivity, with support and encouragement such difficulties can be overcome. Moreover, by encouraging students to reflect upon their Professional Practice, the programme not only enables students to consider how they may apply what they have learnt to their Professional Practice, but also encourages them to think about how they can link their experiences as Professional Engineers to what and how they learn both whilst on the programme but also as lifelong learners.

Keywords

Continuing Education, Work Based Learning, Reflection, Reflexivity, Engineering Education Research

1. INTRODUCTION: REFLECTION & REFLEXIVITY

The argument that the research discussed in this paper set out to critique was that in order to promote professionalism in Engineering Education and Practice, graduate level engineering programmes need to introduce the concepts of reflection and reflexivity into the curriculum right from the onset. As such, student engineers, and those responsible for teaching them, need to reflect upon the epistemological and ontological drivers and underpinnings of their professional practice and think about how past experiences can be used to guide, inform and enhance future decisions.

The link between Professionalism and Reflection in Practice can be traced back to the work of John Dewey (1934), who suggested that the concept of reflection is critical to professional development and to learning, and stated that ... "*... all direct experience is qualitative, and qualities are what make life-experience itself directly precious. Yet reflection goes behind immediate qualities, for it is interested in relations . . .*" (p. 293). In contextualising Dewey's perspective within the fields of Engineering Education and Professional Engineering, it may be argued that whilst an individual may perform a task in what may be perceived to be a professionally acceptable manner, a lack of awareness about how different influences and elements impacting this task may be interconnected could impede individual growth and understanding, and in doing so negatively impact professional practice.

From an epistemological perspective, reflexivity requires that we engage with our current and future professional practice by reflecting upon our assumptions about knowledge, and the theoretical and conceptual underpinning of such knowledge (Nightingale and Cromby, 1999) in such a way so as to influence future practice. Similarly, ontological reflexivity involves reflecting upon our personal and individual approach to life – considering the different factors and experiences that have influenced past decisions and professional practice. Thus it is important for both engineering educators and Professional Engineers to have the ability to reflect upon their practice and consider the different factors impacting their actions and decisions – both epistemologically and ontologically. Having done this, in order to improve and develop practice, reflexivity requires that we consider in some depth what can be learnt from past actions and use this knowledge to guide and inform future decisions.

Put simply, reflection incorporates *looking back* on one's professional practice and reflecting upon one's activities and decisions (Brewer, 2000, 2004; Bryman, 1989, 2001). Whereas reflexivity takes this process one stage further, necessitating critical reflection in which past activities are critically analyzed in order to improve and hone future practice (Giddens, 1991; Alvesson & Skoldberg, 2000; Doane, 2003).

The importance of reflection and reflexivity in Engineering Education is discussed in the literature (Socha et al, 2003; Feest & Iwugo, 2006). Likewise, the need for Professional Engineers to

adopt a more reflective approach to their practice has also been previously raised (Robins, 2007). However, there remains a notable gap in the literature pertaining to the pedagogical issues faced by engineering educators in promoting reflective and reflexive practice in Professional Engineering practice through careful curriculum development and approaches to teaching. It is this issue that this paper begins to address.

2. THE MSC PROFESSIONAL ENGINEERING BY WORK-BASED LEARNING

The MSc Professional Engineering by *Work Based Learning* was developed as part of a Government funded Gateways initiative led by the UK's Engineering Council (EC). It is a collaborative venture with other universities, and a number of Professional Engineering Institutions (PEIs), under the direction of a national steering committee. An "EC Guide to Professional Engineering" provides a prescribed framework comprising general Program requirements. Each university offering the programme has developed their own version, which, whilst conforming to the framework, comprises detailed bespoke delivery methods specific to individual institutional requirements and practices. The programme at Aston University was introduced in April 2010.

Programmes at each institution are autonomous and, as such, not answerable to the EC, the link is through the mapping that means the programme is designed as a path to Chartered status. As a consequence of this, the concept of reflection and reflexivity is built into the programme design *in* that it builds upon the experiences gained from evaluation of the pilot programmes started by the Engineering Council in 2008.

Within Aston University, the programme is delivered and managed by the School of Engineering and Applied Science. That the programme is not attached to any specific department or engineering discipline is reflective of its multidisciplinary nature. Moreover, the programme has been designed to be sufficiently flexible so as to meet the unique needs and professional requirements of engineers from all types of industry, from all technical disciplines, from all age groups, from all backgrounds, and in all geographic locations (this in line with the original Gateways Project aims).

Collaboration is key to the programme success. Such collaboration is manifest by the wide professional and academic backgrounds of the academic and professional supervisors employed to deliver the various modules. Additionally, the programme leaders also collaborate with like-minded universities in regions throughout the world – ensuring that wherever engineers are geographically located they will be able to access the opportunities the course makes available. Likewise, quality assurance is fundamental to the success of the programme – as such it adheres to the usual University standards, requirements and practices.

The programme is designed according to UK-SPEC and in line with the Engineering Council's output standards for accredited Degree Programmes. Chartered Engineer status is not guaranteed, but is dependent upon the individual engineer being able to demonstrate the required competences.

Upon enrolling on the programme, Engineers are required to take 5 core modules, and 4 optional ones. The programme itself is distinctive in that it is entirely underpinned by the principles of Problem and Project-Based Learning. In acknowledging that Professional Engineers are increasingly called upon to solve an array of complicated local, national and international problems, including those related to global warming, sustainability and pollution (IMEchE, 2009; RAEng, 2008), the programme aims to equip Engineering Students with the knowledge and skills to work in an ever more demanding environment. The fact that such problems, whilst usually Engineering or Science based, tend to be multi-faceted in nature means that more than ever, Professional Engineers are required to be able to 'think out of the box' (Lucena et al, 2008; RAEng, 2007).

2.1 Reflection and Reflexivity in the MSc Professional Engineering

The first part of the programme is a core module that requires students to undertake a Personal Development Audit (PDA). Comprising three distinctive components: The Evaluative Review; A Competency Mapping Report and; A Learning Agreement, this module underpins the rest of the programme. The Evaluative Review (ER) is credit-bearing whilst the other two components are subject to approval by the relevant Professional Body (as well as by the University). In developing the learning and teaching tools for the ER, the programme lecturers have adopted an approach that incorporates reflective and reflexive practice right from the onset. This approach encapsulates a unique cross-disciplinary pedagogy that meets the diverse needs of the individual engineers enrolled on the programme. The programme is delivered by means of five interlinked, but separate, Work Packages¹. Each of these was developed specifically for the programme in a manner suitable for distance learning. By making sure the principles of reflection and reflexivity are built into the PDA right from the beginning – the programme is designed in such a way so as to encourage students to apply similar principles both to their professional practice and to the remaining modules. In adopting such an approach, the PDA lecturers and Programme Director aim to equip individual students with the high level skills and competencies required for success in modern-day Professional Engineering.

¹ The Work Packages are: 1. Understanding Learning Styles and Approaches: 2. Critical Thinking in Professional Engineering: 3. Critical Reading & Academic Writing in Studying Professional Engineering: 4. The Engineer in Organizations: 5. Becoming a Profession Engineer – The Role of Reflection & Reflexivity

3. THE STUDY

3.1 Methodological Approach

Utilising an Action Research approach (Norton, 2008) exploratory research has been conducted aimed at analyzing student and staff perceptions of the role of reflection and reflexivity in Engineering Education and professional practice. The first stage of this process has been to undertake a 'Narrative Analysis' of students' Evaluative Reviews [ERs]. It is this analysis that forms the basis of this paper. In total, 10 ERs were analyzed comprising a total of just over 30,000 words. The reflective and reflexive content of the ERs make them the ideal medium with which to conduct a Narrative Analysis. In discussing the methodological rationale for such an approach, Coffey & Atkinson explain that a Narrative Analysis provides researchers with the opportunity to determine ...*"How actors retell their life experiences as stories.. [this]... can provide insight into the characters, events and happenings central to those experiences"* (p 69).

In order to deal with issues of validity and reliability in the process of analyzing the students' ERs, the documents were first anonymised. Following this, an 'analytical framework' was developed enabling the researcher to analyze the data through systematic coding and categorizing (Cousin, 2009). The data was broken down into 'manageable' units of analysis (Cohen et al, 2007) and comparative themes and sub-themes identified. The findings were then collated and summarized for the purposes of curriculum development. This summary is given below.

3.2 Findings

Three main but similar themes were identified during the course of the analysis. The first of these pertained to the students' propensity to focus on epistemology and technical description when discussing past experiences. The second theme centred upon students' experiences of management, and the third on students' perceptions of their own learning approach / style. Each of these is now discussed.

1. In undertaking the analysis, the most notable similarity across all of the ERs was that the writers (Engineering Students) all appeared to have some difficulty with the act of 'reflecting' and even more difficulty being 'reflexive'. As a Distance Programme, the MSc is designed in such a way so as to provide a supportive pedagogical learning environment. Students are encouraged to seek formative feedback prior to submitting their final work. As a consequence of this each ER included within the study had been through 1 or 2 iterations. Despite this, there was a tendency for the students to focus very much on the technical aspect of their past experiences. In reflecting, they all tended to concentrate on the epistemology of their past experiences – preferring to reflect in great length on the objective 'engineering and scientific' underpinnings of their actions and decisions, rather than critiquing such experiences ontologically and subjectively.

2. One of the 'non-technical' issues discussed in all of the ERs related to the students' past experiences of either dealing with their line managers or supervisors; or of line managing or supervising others. In all cases, it was evident that the students' found the task of reflecting upon the relational (ontological) aspects of their experiences extremely difficult. Whilst some cited examples of management practice (good and bad), little or no attempt was made to explain or analyze such experiences by referring to the academic literature pertaining to organizational or strategic management. Furthermore, the majority of students did not discuss how or what they had learnt from their past managerial relationships – with only two students discussing how they could do things differently in the future as a result of a past experience. From this perspective, the majority of the reflection in the ERs was overwhelmingly descriptive – with students struggling to move beyond reflection and description to achieve reflexivity and critique.

3. The Work Packages encourage all of the students to reflect upon their past learning experiences and to consider how such experiences might impact their future learning (both on the programme and beyond). A certain amount of 'reflection' was evident in all of the ERs, with all of the students using Kolb's (1984) work as the basis of their reflection (this is included in the Work Packages). As with the reflective discussions about management, the majority of the students provided a detailed description of what they perceived to be their learning approach. Half of the students built on this, and described in some depth how their learning style / approach had changed through time. None discussed how they could use their past learning to inform, shape and guide their future approach.

4. DISCUSSION

4.1 The implications of the study for future teaching practice

Arguments that in order to achieve high quality scholarly outcomes, university teachers need to adopt an approach to teaching similar to that of research (founded upon academic rigour and evidence), have long been discussed in the literature (Elton, 2005 & Healey, 2000). Such arguments suggest that in order for academic staff to improve their practice, they should receive formal training in how to become critically reflective and reflexive teachers and researchers (Giddens: 1991, Alvesson & Skoldberg: 2000, Doane: 2003, Finlay & Gough: 2003).

Learning from past experiences – whether positive or negative, is essential when considering how to improve and enhance future professional practice – both for Professional Engineering students, but also for those responsible for their education. The findings of this short study, when contextualized with the literature, begin to provide evidence to suggest that in order to promote professionalism amongst Professional Engineering students, the concepts of reflection and reflexivity need to be embedded into the curriculum. It is acknowledged that this study is in its very early stages, however, the Action Research nature of

the Research Design is such that by identifying the difficulties experienced by students in developing as reflective and reflexive Professional Engineers, the lecturers responsible for the ER have been able to put into place a number of support mechanisms to help students develop in this area.

The students whose work was analyzed as part of this research were all enrolled as Distance Learners – originating from Africa and Asia. All had studied Engineering to Bachelors Level in the ‘traditional’ manner. In addition to identifying issues pertaining to reflection and reflexivity, the in-depth Narrative Analysis undertaken in the course of the study has enabled the researchers to identify key pedagogical issues arising in the early stages of such a programme. Such issues vary in nature from the need to make sure the students are all fully prepared to study at graduate level (from the perspective of academic skills and competencies), to the need to make sure that the remaining Programme Modules are delivered in a cohesive and professional manner (that relates to each individual student’s work and life experiences). As such, the ER has become an essential part of the whole programme. It allows students the time and space to consider how to compose their ‘Competency Mapping Report’ and provides them with the means by which they can identify the areas they need to work on from a professional perspective. The individually ‘tailored’ nature of the programme means that the remaining ‘technical’ modules are delivered in such a way so as to benefit both the learner and the organization in which they are employed. In this way reflection and reflexivity become key to student success.

CONCLUSION

This paper has provided a brief overview of the emergent findings of a critical analysis of the role of reflection and reflexivity in promoting Professionalism amongst graduate level Professional Engineering Students. The findings of the Narrative Analysis begin to provide evidence that whilst engineers may struggle with the concepts of reflection and reflexivity, with support and encouragement such difficulties can be overcome. Indeed, by embedding reflection and reflexivity into the programme right from the onset, the Programme Lecturers and Director have developed a model that promotes professionalism from the onset. Engineers enrolled on the programme are encouraged to take responsibility for their own learning. Moreover, the *lateral* nature of the approach means that the students not only consider how what they learn might be applied to their practice, but also, conversely, begin to consider how their professional practice might influence what and how they learn.

The second part of this research (interviews with Academic and Professional Supervisors, Lecturers and Industrial Partners) is ongoing. However, in conclusion, the emergent evidence of the study findings thus far support the argument that the approach described within this paper is particularly suitable for Distance Learning, Work Based Engineering Education. Indeed, it may be argued that the Evaluative Review acts as the academic and professional ‘glue’, binding together the different aspects of the

programme, whilst allowing for individual input and acknowledging disciplinary and professional differences.

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