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Research Stream: Learning and teaching

Forging Futures: Enhancing Employability Through Work-Based Learning

Abstract

The value of providing students with high level work-based training is reflected in the literature with much emphasis being given to the role of education in preparing undergraduate students for the world of work (see for example, Gleeson & Keep 2004, Billett 2008, Bennett & Kane 2009, Jackson & Jamieson 2009, Longhurst 2010). However, whilst such training undoubtedly has its merits, in engineering education in particular, difficulties in assessing and evaluating such activity-based learning (McKenna & Laycock, 2004; Melin et al; 2009) means that the added-value of work-based learning programmes is somewhat difficult to capture. Based upon the findings of an exploratory study, this paper critically discusses the pedagogical and practical issues of assessing and evaluating the value of work-based learning in undergraduate level engineering education programmes.

Introduction - Background: Work-Based Learning in Higher Education

Pivotal to 'securing economic prosperity' (Gleeson & Keep 2004; Bennet & Kane, 2009) Higher Education in the UK plays a substantial role in 'workplace learning and workforce development' (Lester & Costley, 2010, p 562). A key recommendation of the Leitch Report (2006), the requirement that partnerships between HE and industry should be nurtured and developed is manifest both in an increase in the number of work-based learning opportunities available in Higher Education (Lester & Costley, 2010) and also in increased recognition of the value that work-based learning provides for students, employers and institutions (Gibson & Busby, 2009). A complex and often contested concept, it may be argued that work-based learning has a critical part to play in building individual, institutional and national capacity and sustainability. This is particularly the case in engineering education where, from a pedagogical perspective, work-based learning has an important role not only in equipping undergraduates with high level transferable skills (Crebert et al 2004, Gibson & Busby 2009; Lester & Costley 2010) but also in promoting life-long learning (Bohloko & Mahlomaholo 2008).

By providing students with real-life learning activities, work-based learning provides an integral link between education and employment (Billet, 2008). However, the value of work-based learning is not simply 'one-sided', linkages forged between employers and higher education in the provision of work-based learning programmes can do much to enhance the reputation of both partners with... '...the institution for instance attracted by a partnership with a large, high-profile organisation, [and] the employer seeing the kudos of a university stamp on its in-house development processes and the benefits of offering its staff higher education qualifications'. (Lester & Costley, 2010, p.570)

Whilst work-based learning is generally construed positively, the need to provide sufficient high quality support for students on industrial and professional placements should not be underestimated (for further discussion, see for example, Askham 2008; Gibson & Busby 2009). Indeed, at the level of the individual student, attention needs to be paid to ensuring that the experience is both academically enriching and professionally relevant whilst providing the student with the opportunity to contribute to the organisation in which they are placed (Bennett & Kane 2009; Gibson & Busby 2009).

From an engineering education perspective, difficulties in evaluating the student learning experience in relation to activity and work-based learning are discussed in the literature (McKenna & Laycock, 2004; Melin et al; 2009). Likewise, problems with assessing and evaluating professional competencies in engineering are also noted (see for example Liang & Elder, 2008; Pape et al., 2008) with difficulties ranging from problems in aligning learning outcomes so as to inform curriculum development (see ALOE, 2011), to questions of how to develop assessment approaches which meet the need for students to achieve the prerequisite level of competencies required by Employers, Professional Bodies and Academia. Drawing upon the emergent findings of an exploratory study, this paper critically discusses the issues surrounding work-based learning in engineering education. It looks specifically at assessment and evaluation and provides a critical evaluation of the various pedagogical approaches utilized within the discipline. In doing so the paper adds to current debates in this area by providing a critical overview of the value of industrial placements both from the student and the institutional perspective. By beginning to address a key question in engineering education, that of ... *exactly how do we best*

assess when someone is professionally competent ... the paper makes a notable contribution to both engineering education and to the wider pedagogical field.

Methodological Approach

This study employs a mixed methodological design informed by critical realism (Bhaskar, 1975) that is applicable to both theoretical and practical perspectives. The key ontological principle of critical realism is the existence of a stratified '*real world*' (Bhaskar, 1979) – indeed, it is the '*real world*' of work-based learning that the study seeks to investigate. From a critical realist perspective, a mixed method design is appropriate as a combination of quantitative and qualitative methods provides insight into different aspects of the phenomenon under investigation and in doing so enables identification and analysis of causal mechanisms (McEvoy and Richards, 2006). Within this study, utilising such an approach has enabled the research team to investigate the issues from both pedagogical and practical perspectives.

Findings

For the purposes of data collection and analysis, research activities were divided into three distinctive yet interlinked strands: The Student Experience: Pedagogic Issues: and, Employer Perspectives. By exploring the relationships between the strands of activity, the researchers have adopted an approach that has embedded and contextualised the research into situated practice (Wenger, 1998). Indeed, by focusing specifically on how work-based learning promotes and enhances the student experience through real-life learning, and by looking at the pedagogical, practical and professional issues surrounding evaluating and assessing work-based learning, the study provides a '*realistic*', comprehensive and robust account of the impact of work-based learning on engineering students' experiences.

Discussion & Conclusion

The paper provides a critical discussion of the emergent research findings. It provides an overview of the key difficulties of both assessing and evaluating work-based engineering education and considers how the lessons learnt from the study might be used to improve the student experience whilst adhering to the strict criterion laid down by professional and academic bodies. In analysing, pedagogical, professional and industrial requirements and expectations, the research provides a

strong foundation for the further development of work-based learning across the Sector.

In conclusion the paper contributes to the ongoing debate about how universities can best respond to the varied drivers acting on engineering education (RAEng, 2010). Preparation for work in industry is clearly important, yet it must be achieved through well designed curricula and the associated appropriate assessment. Work-based learning 'ticks many industry boxes' and is a worthwhile experience for students, yet it must also be subject to rigorous assessment and be part of a well structured programme of study.

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References

- ALOE. (2011), *Assessment of Learning Outcomes in Engineering Working Group*. Available from: <http://www.aloe.ac.uk/> Accessed 2/2/11.
- Askham, P. (2008) Context and identity: exploring adult learners' experiences of higher education. *Journal of Further and Higher Education* 32(1) 85-97.
- Bhaskar, R. (1975) *A Realist Theory of Science*. Brighton: Harvester Press.
- Bhaskar, R. (1979) *The Possibility of Naturalism*. New York: Humanities Press.
- Bennett, R. & Kane, S. (2009) Employer engagement practices of UK business schools and departments: an empirical investigation. *Journal of Vocational Education and Training* 61(4)495-516.
- Billett, S. (2008) Realising the educational worth of integrating work experiences in higher education. *E-Proceedings WACE Asia Pacific Conference* 30 September-3 October, Sydney Australia, 41-55
- Bohloko, G. & Mahlomaholo, S. (2008) Work Integrated Learning Quality Partnerships: The case of the Central University of Technology, Free State. *E-Proceedings WACE Asia Pacific Conference* 30 September-3 October, Sydney Australia, 56-66.
- Crebert, G. Bates, M., Bell, B., Patrick, C-J. & Cragnolini, V. (2004) Developing generic skills at university, during work placement and in employment: graduates' perceptions. *Higher Education Research & Development* 23(2) 147-165.

Gibson, P. & Busby, G. (2009) Experiencing work: supporting the undergraduate hospitality, tourism and cruise management student on an overseas work placement. *Journal of Vocational Education and Training* 61(4) 467-480.

Gleeson, D. and Keep, E. (2004) Voice without accountability: the changing relationship between employers, the State and education in England. *Oxford Review of Education* 30(1) 37-63.

Jackson, S. & Jamieson, A. (2009) Higher education, mature students and employment goals: policies and practices in the UK. *Journal of Vocational Education and Training* 61(4) 399-411.

Liang D & Alder, C. (2008). "Good Marks Do Not Necessarily Make a Good Engineering Degree," *Proceedings of the 7th Annual ASEE Global Colloquium on Engineering Education*, Cape Town, South Africa, October 19-23, 2008 (2008)

Leitch Review of Skills Final Report (2006) Prosperity for all in the global economy: world class skills. The Department of Education and Skills.

Lester, S. & Costley C. (2010) Work-based learning at higher education level: value, practice and critique. *Studies in Higher Education* 35(5) 561-575.

Longhurst, D. (2010) Chapter 3: Crossing Boundaries: Foundation Degrees in England. *Community College Review* 38 (2) 151-175.

McEvoy, P. & Richards, D. (2006). A critical realist rationale for using a combination of quantitative and qualitative methods, *Journal of Research in Nursing*. 11, 66-78.

McKenna, P. & Laycock, B. (2004). "Constructivist or Instructionist? Pedagogically Applied Concepts Practically Applied to a Computer Learning Environment". *Proceedings of 9th SIGCSE Conference on Innovation & Technology*. Available from <http://delivery.acm.org/10.1145/1010000/1008041/p166-mckenna.pdf?key1=1008041&key2=1662316921&coll=DL&dl=ACM&CFID=7683843&CFTOKEN=27894535>. Downloaded 27th January 2011.

Melin, U., Axelsson, K. & Wedlund, T., (2009). "Project-based Learning – An Emergent framework for Designing Courses". *Information Systems Education Journal*. 34. 7. pp 3-11.

Pape, F., Ruffert, C., & Gatzen, H.H.. (2008). *Professional Improvement by Study in Engineering Sciences*. Available from: <http://www.buid.ac.ae/iamot2008/photos/1569088986.pdf> Accessed 2/2/11

Royal Academy of Engineering (2010). *Engineering Graduates for Industry Report*. Available from http://www.raeng.org.uk/news/publications/list/reports/Engineering_graduates_for_industry_report.pdf Accessed 27/6/11

Wenger, E. (1998). *Communities of practice: Learning, meaning and identity*. Cambridge:Cambridge University Press.