ANALYSIS OF STUDENT AND STAFF EXPERIENCE IN INDUSTRIAL PROJECTS

Solomon Alexis, Mike Kretsis, Gaurav Malik

University of East London
London /UK
a.s.alexis@uel.ac.uk, m.kretsis@uel.ac.uk, g.malik@uel.ac.uk

Abstract

Engagement with industry is a topical issue within the computing academic community. Such engagement can take a variety of forms including the traditional year-long student industrial placement but also short term projects, many of which are publicly funded. This paper describes the experiences of both students and staff within the School of Computing, IT and Engineering at the University of East London and the various industrial activities in which they have been engaged. The paper will investigate how industrial engagement can benefit the various stakeholders and identify some of the challenges and opportunities presented by the various types of industrial engagement.

Keywords - Industry engagement, university/industry experiences, university/industry programs

1 INTRODUCTION

Research over the years has shown that students learn by doing[1][2]. In subjects such as Computing, the practical application of theory helps underpin the students' grasp of the subject. Complex concepts like routing algorithms are more easily understood by students when applied in a practical scenario. Furthermore, evidence suggests that by engaging in practical work, the learner will retain greater amounts of knowledge than he or she would otherwise do[3]. Within the School of Computing, IT and Engineering (CITE), staff have a long tradition of running Computing courses with significant practical content, content which reflects the needs of the IT industry. This content has been delivered both by the development of innovative curricula and by regular and continued engagement with industry.

The importance of practical work is not the only characteristic that distinguishes the study of Computing from the study of many other disciplines. Students of Computing must also keep their knowledge and skills up-to-date in a rapidly changing environment. Engagement with industry provides opportunities for both students and staff to gain valuable experience of some of the very latest developments in IT. Such opportunities will not always be available within the confines of the University campus where resources are often scarce and budgets typically limited.

2 A PEDAGOGICAL APPROACH TO INDUSTRIAL ENGAGEMENT

The authors believe that there are sound pedagogical reasons for encouraging students to engage with industry. In particular, our attempts to encourage engagement are informed by the ideas of constructivism, examples of which include Dewey's theory of Social Activism [4] and Vygotsky's Theory of Scaffolding [5]. Central to constructivist approaches to learning is the idea that learners construct knowledge (and reality) for themselves by actively engaging with concepts and information in their environment. As part of this active learning process, meaning is developed on the basis of experience and inquiry [6]. A constructivist approach requires that situated learning, social negotiation and multiple perspectives as learning strategies are adopted to assist the learner in his or her quest for knowledge [7]. Doolittle [8] goes further by describing the conditions that must hold if a constructivist approach is to succeed:

- Authentic (and real-world) presentations
- Provisions for social negotiation and meditation
- Relevant content and skills
- Taking into account the prior knowledge of the learner and recognising that they can be relevant
- Contextualised assessment that serves to direct future learning
- Encouragement of the learner to self-regulate, self-mediate and be self-aware

- Adoption by lectures of “scaffolding” for students
- Prevalence of multiple perspectives and representation of content in every activity

Engagement with industry through schemes such as the traditional industrial placement and, more recently, the various short term projects provides an environment in which not only can the learning strategies identified by Nunes and Fowell be adopted but also Doolittle's conditions, or at least the majority of them, can be satisfied. Furthermore, as Driscoll [9] has pointed out, the learning environment within industry-based projects enables lecturers to

- Embed learning in complex, realistic and relevant environments
- Provide for social negotiation as an integral part of learning
- Support multiple perspectives and the use of multiple modes of representation
- Encourage ownership in learning
- Nurture self-awareness of the knowledge construction process

3 INDUSTRIAL ENGAGEMENT WITHIN THE SCHOOL OF COMPUTING, IT AND ENGINEERING

Embedding industry-based projects within degree courses is not a new phenomenon. A search of UCAS [10] revealed that 687 of the 2,828 computing programmes in the UK were listed as sandwich programmes. As long ago as 1997, the Dearing report [11] encouraged student industry engagement as a foundation of future education practices.

According to Perkmann and Walsh [12], academic research and industrial engagement fits one of three patterns, that of opportunity-driven, commercialisation-driven or research driven. We are restricting our work to engagements that contain both student and academic involvement.

In a report entitled ‘Enhancing employability, recognising diversity’, Universities UK [13] differentiates between the various forms of work placements. Whilst we shall be focussing our attention on ad-hoc, short term student placements in this section, traditional year-long industrial placements are still an important part of our engagement with industry.

CITE, through links with the University of East London’s (UEL) enterprise development service (known as the Knowledge Dock), has engaged in a variety of schemes which have resulted in the creation of short and medium term projects in which both students and academic staff can engage with industry. These schemes include

- Shell Step: This is one of the longest running student schemes [14]. The scheme has been running for 20 years and has delivered 22,000 projects.
- London Innovation Placement Programme (LIPP): This London Development Agency funded programme offers small businesses access to undergraduates, postgraduates and recent graduates. Projects can last up to 12 weeks. Academic engagement is optional.
- Innovation Associates: This is an ERDF (European Regional Development Fund) funded project which provides companies with access to undergraduates, postgraduates and recent graduates. Projects can last up to 6 weeks. Academic engagement is optional.
- Knowledge Transfer Partnership (KTP): Originally KTPs ran for 1-3 years. Over the last year new KTPs, which last from 10 – 40 weeks, have been introduced. KTPs are restricted to graduates and postgraduates. Academic engagement is compulsory.

Tables 1, 2 and 3 summarise the various schemes in operation within UEL and the number of students and staff involved across UEL as a whole and within CITE.

Table 1. Student driven industrial engagement schemes running within UEL

	Open to Graduates	Govt. Funded	Paid Placement	Academic Support
Shell Step	Yes	No	Yes	No
London Innovation Placement Programme	Yes	Yes	Yes	Optional
Innovation Associates	Yes	Yes	Yes	Optional
Knowledge Transfer Partnership	Yes	Yes	Yes	Yes

Table 2. Number of Students placed within the schemes

UEL/CITE	2006	2007	2008	2009
Shell Step	3/0	2/0	2/1	9/4
London Innovation Placement Programme			4/2	7/4
Innovation Associates				6/3
Knowledge Transfer Partnership				1
Final Year Placement (CITE Only)	8	4	8	2

Table 3. Number of staff involved with the schemes

UEL/CITE	2006	2007	2008	2009
Shell Step	3/0	2/0	2/1	9/4
London Innovation Placement Programme			11/4	2/2
Innovation Associates				8/4
Knowledge Transfer Partnership				

4 THE MOTIVATION BEHIND THE STAKEHOLDERS

By engaging in industrial projects, companies gain access to the intellectual wealth of a university. Some companies engage more that one student in the hope of gaining access to a wider range of skills and knowledge. In one example of a project at UEL, a company engaged a Business Studies student to help develop a marketing plan and a Computing student to develop a website whose need was identified by the marketing plan. The added impetus of academic input makes taking up a project economically beneficial to the company.

Within the greater academic community, academic consulting is widely practiced [15]. Within CITE, academics are encouraged to build industrial links to help inform both their research and teaching. By doing so, academics gain access to new markets and data sets. These can result in possible publications, case studies or future collaborations. Lam [16] states that career incentives and knowledge flow are also major contributing factors for the establishment of industry-university links. With a move towards greater professionalism, there is also a move for IT professionals to achieve chartered status. In a report entitled 'Engineering Values in IT' [17], a joint study by The Royal Academy of Engineering, the Institution of Engineering and Technology and the British Computer Society, IT professionals are encouraged to achieve chartered status. Industry engagement can help academics meet the requirements of the Skills Framework for the Information Age (SFIA) Level 5 which is a core part of the achievement of chartered status.

It is not just companies and academics that benefit from industrial engagement. Students gain confidence, learn new skills and develop themselves through practice. Students gain by applying their academic knowledge in a practical setting. Working with a company also gives students insight into the workplace and can influence their future careers. In interviews carried out with students from CITE the primary reasons students gave for their involvement in industrial projects was the development of new technical skills and their communication skills. This ties in with the survey by Parity [18] which states that 70% of IT managers identify good communication skills as crucial for the successful functioning of IT project teams.

Does participation in industrial projects have a beneficial impact on students' performance? A preliminary analysis of data covering the period of 2004 – 2008 indicates that the average degree classification of students from CITE who participate in a year-long industrial placement is consistently in the middle of the upper second class range. This level of performance is certainly above what we

would expect for our students as a whole. However, more analysis is needed to prove that this is actually the case.

5 THE CHALLENGES FACED BY THE STAKEHOLDERS

Lamancusa et. al [19] commented that "[only] a minority of engineering faculty are now registered as professional engineers or have practiced engineering in an industrial setting." This lack of industrial experience makes it difficult for support staff to find suitable academic supervisors for industrial projects. In our experience, the vast majority of industrial projects tend to market driven. They require both the students and the supervisor to be well versed in the latest technologies. In the ever-changing world of computing this is a particular challenge.

When interviewed, academic staff within CITE who had been involved in industrial projects did indeed identify the problem of keeping themselves abreast of the latest technological developments as one of their major challenges. This challenge can be addressed by appropriate training but attracting funding for this training can be difficult.

Based on a number of interviews with students within CITE who have participated in industrial projects, one of the main challenges, from a student's perspective, appears to be the lack of technical skills. The student's knowledge has to be matched against the company's expectations. This match making service can be challenging because companies expect students, as well as academic staff, to be versed in the latest tools in use in the marketplace. This often results in students having to upskill in a short period of time. Supervisor intervention is invaluable in this situation, helping to guide the student on the correct learning path.

The lack of technical skills and the need to continually keep abreast of technological developments were not the only problems identified by academic staff and students. Time management was also identified by both staff and students as an issue. Academic staff are faced with the challenge of managing workloads and running courses in an environment based around semesters or terms. Companies do not work in semesters and terms. This difference in working culture is also a major contributing factor to the problems associated with setting up industry-based projects. As Cyerat and Goodman [20] say "Most companies think about time in terms of meeting quarterly goals and other short-term constraints. For the university, time frames are much longer term and less well-defined. Few quarterly goals exist." It is the mismanagement of this cultural difference which can result in the failure to deliver projects. Students find it difficult to juggle their various commitments including part-time work, family and study in addition to an industrial engagement. Our experience so far suggests that the timing of industrial engagements is therefore crucial. Paradoxically, students are more likely to participate and to succeed if the engagement takes place during their vacation rather than during term time.

6 CONCLUSIONS

The experience of the students at UEL that have engaged with industry has generally been very positive and there is evidence, albeit limited at present, to suggest that the students both enjoy the experience and find it helpful in the long run. In addition, a preliminary analysis of the statistics suggests that this group of students performs well in the final year of their degree. What is not clear, however, is the extent to which this group outperforms its peers who do not engage with industry nor is it clear the extent to which the experience of industrial engagement contributes to good final year performance. It may well be that those students who engage with industry tend to be more able and, consequently, would do better than their peers regardless of any industrial engagement. More research is required to isolate the factors that contribute to the apparently strong performance of this group. Furthermore, whilst there is some evidence that suggests that students do benefit in general terms from industrial engagement, a more detailed analysis is required in order to determine precisely how the students benefit. Is it simply the case that industrial engagement leads to improved final year grades or are there other less tangible but nevertheless important benefits. More analysis is required to identify the ways in which industrial engagement adds value to the experience of our students.

It is not just students who benefit from engagement with industry. All the major stakeholders benefit. Academic staff gain exposure to the needs of industry and companies benefit from accessing the universities' knowledge bases.

The key challenges of industrial engagement are that of time and skills. Students have the pressures of assessment, part-time work and family commitments, academics of teaching constraints and companies of the time to market. The timing of the industrial engagements is therefore important. Furthermore, additional funding needs to be made available to academic staff who wish to engage in industrial projects to keep them up-to-date with the latest technological developments.

In our experience, the success of industrial projects depends, to some extent at least, on the type of engagement. Short-term projects like the LIPP and the Innovation Associates scheme have shown themselves to be generally more successful in recent years than the traditional industrial placement for two main reasons. Firstly, most of our students, these days, find it impossible to commit to a year-long placement. Secondly, these short-term schemes attract funding which can be used to release academic staff from their teaching commitments and hence, make it easier for them to participate in industrial projects.

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