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# Using Students with Current Industry Experience to Evaluate Course Delivery*

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This paper considers the opportunity for academic-industry collaboration that arises when a proportion of engineering students in a cohort are part-time students with current industry experience. It describes a study that took the opportunity of probing the response of these students to aspects of course design, using their perspective to answer the questions: 'How successful are we in our attempts to create realistic project work for students, and what improvements should be made?' The consensus from semi-structured group interviews with 52 students is that the project work they have experienced is generally realistic from a technical point of view, enhanced by basing projects on a real site, using real data, and working with a realistic brief. Some students considered the briefs to be too open-ended to be realistic, but others relished the opportunity this presented. Team-working aspects of university group projects were not considered realistic by the students; they pointed out that the environment in engineering practice is very different because it is moderated by the management structure and professional expectations of staff. The role of a client figure was identified as important in creating realism. The paper considers the potential conflict between some aspects of realism in project work and educational benefit.

**Keywords:** part-time students; course evaluation; realistic project work; team-work

## 1. Introduction

An important opportunity for academia-industry collaboration arises when a proportion of engineering students in a cohort are part-time students with current industry experience. This paper considers the opportunities presented by these students. Fundamentally they are opportunities for learning. Full-time students can learn from part-time students, and these opportunities are described in the Background to the paper. Also staff teams can learn from these students, through the currency of their industry experience and their feedback on course delivery, especially aspects that are intended to create engineering realism. The latter forms the main topic of the paper: using students with current industry experience to evaluate those aspects of course delivery.

At Coventry University, UK, 30% of civil engineering students study part-time, attending the university on day release and working in the industry for the remainder of the week. Nearly all of these students have several years' experience in civil engineering and some have jobs that carry significant responsibility. They are taught and assessed together with full-time students.

The course, BEng Civil Engineering (3 years full-time), includes several significant group projects in which students work on realistic briefs. In year 2, students work on a feasibility study for development of a brown field site based on an actual location. They learn to work collaboratively in a team to investigate a civil engineering problem, and to integrate knowledge from a range of engineering topics. They also work on a structural design project with a brief from industry. Here they learn to apply principles of structural design to a realistic case that requires judgement in the selection of appropriate methods. In year 3 all disciplines in the Department of Civil Engineering, Architecture and Building work in multi-discipline teams on a realistic design and construction project, with a brief based on a real case, and supported by inputs from practitioners and by real site data. Students learn to work effectively in multi-discipline teams, and develop problem-solving skills through the experience of a realistic and complex challenge.

The study described in this paper took the opportunity of probing the response of part-time students to aspects of course design, benefiting from their concurrent experience of engineering practice and of being a student on an engineering degree course. Specifically the study aimed to use the perspective of these students to answer two questions: 'How successful are we in our attempts to create realistic project work for students?' and 'what improvements should be made?'

## 2. Background

This section aims to place the study in context by considering the importance of creating realism in engineering courses, the characteristics of part-time civil engineering students, and initiatives at Coven-

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try University aimed at allowing full-time students to learn from part-time students.

The Royal Academy of Engineering [1] has stressed that 'universities and industry need to find more effective ways of ensuring that course content reflects the real requirements of industry', and [2] has presented case studies of 'experience-led engineering degrees'. Many researchers have referred to the processes by which engineering students develop the attributes of practising engineers. Lindsay et al. [3] identify the distinction between an 'engineering student' and a 'student engineer', and describe how they provide a learning environment which is 'designed to be as authentic a representation of an engineering workplace as possible'. They see this as relating to learning and also to behaviours (of typical students compared with professional engineers). Poitras and Poitras [4] use the educational concept of 'cognitive apprenticeship', in supporting the development of engineering students' use of authentic practices in a way that is similar to craft apprenticeships.

A study by Davies [5] demonstrated that part-time students of civil engineering at Coventry University outperform full-time students academically in spite of having generally lower qualifications on entry. Performance in individual modules was studied: specifically all civil engineering modules in year 2 of the three-year course, in four consecutive academic years. The modules were delivered to part-time and full-time students together. All aspects of module delivery including coursework submission requirements were identical for the two groups of students. In these modules the mean of all the part-time average marks was found to be six percentage marks higher than the mean for all full-time average marks. The study attributed much of this relative success to the skills, attitudes and motivation that part-time students had developed in the work-place. Overall the study emphasised the importance of course teams seeing part-time students as a resource.

At Coventry University there are various initiatives in place to allow full-time civil engineering students to learn from their part-time colleagues. For example a mentoring scheme [6] allows part-time students to act as mentors to full-time students creating the opportunity for full-time students to have structured contact with a practising professional who is close in age and outlook to themselves. This is in order to harness the knowledge and experience of the part-time students to enhance the full-time students' awareness of the civil engineering profession and of the skills required for success. The part-time students receive training in mentoring and then, with the full-time student(s) they are mentoring, discuss the world of civil engineering and also the course itself.

Another initiative for allowing full-time students to learn from part-time students is a managed approach to group formation for project work. In project work in year 3, civil engineering students work with students of architecture, architectural technology, building services engineering, building surveying, construction management and quantity surveying. In 2010/11, part-time and full-time students were deliberately mixed in the group formation process, with group membership determined by staff. In previous years a variety of approaches to group formation had been used. A study based on semi-structured individual interviews with part-time and full-time students [7] was carried out to investigate student perceptions of this arrangement. There was a strong consensus among full-time students that they benefitted from having part-time students in their group. The main benefits cited were the part-time students' industry experience, their organisational and time-management skills, and their access to example documents and resources from work. The full-time students gained an awareness of the value of the professional skills that the part-time students had developed at work and that they displayed in group project work.

There has been another interesting study of interaction between part-time and full-time students in project work in civil engineering at Coventry University, this time in year 2. Students working in groups of 5 develop proposals in response to a realistic brief [8]. The cohort contains the mix of full-time and part-time students already described. In 2009/10 students had been free to form their own groups, and the part-time students had all chosen to work with other part-time students. In 2010/11 students were placed in mixed groups (based on a skills audit of all students) and part-time students were distributed between groups. In 2009/10, the average mark for part-time students was 10.6% higher than the average mark for all students, and the average mark for full-time students was 3.0% lower. In 2010/11, the average mark for part-time students was 6.9% higher than the average mark for all students, and the average mark for full-time students was 0.5% lower. While not proving the value of any particular approach to group formation, this study certainly suggests there is merit in considering the composition of groups in terms of mixing those who have current experience of the industry with those who do not, even though the benefits (in terms of marks at least) appear to go to those without the experience.

## 3. Methodology

As has been stated, the aim of the study that is the main subject of this paper is to use the perspective of

part-time students with current industry experience to answer the questions 'How successful are we in our attempts to create realistic project work for students?' and 'what improvements should be made?'

The study was based on a series of semi-structured group interviews with students. The interviews were carried out by four members of teaching staff in the Department who are involved in the organisation of realistic project work in various years of the course. No member of staff interviewed students they were supervising for project work at the time.

In addition to part-time students, another relevant group of students was considered to be those who have completed a year-out industrial placement as part of a sandwich degree and returned to studying full-time (typically between 20% and 30% of full-time students). These students have less industry experience than the part-time students but still have a combination of experience as a student and experience of the industry.

42 part-time students were interviewed in 12 groups. 10 sandwich students were interviewed in three groups. The sample represented over 50% of the population. Group interviews were used to achieve some efficiency, to promote discussion, and to offset any power issues between staff and students. It was felt that students in groups would be less likely to tell interviewers (known to them as lecturers) what they thought they wanted to hear. But the structure of an interview was preferred to the more open but potentially less controlled atmosphere of a focus group (especially as four different staff were involved).

Interview topics included technical aspects, teamworking issues and the role and relevance of professional attributes, and an indicative interview design was agreed by the four interviewers in advance of the interviews.

Afterwards each interviewer carried out a thematic analysis of their interview data. This was followed by a discussion by the four researchers of the emerging themes of most significance. Then further thematic analysis of the full data set was carried out.

## 4. Main results

### *4.1 Achieving realism*

The students felt that in general the projects (described in section 1) were realistic in terms of technical content. The main components that contributed to creating realism were basing projects on a real site, especially a local site that could be visited, using real data (for example site investigation data), and working with a realistic brief. Many of the students interviewed could see that there was an element of simplification, but that the projects remained realistic.

The students felt that this realism was important to make the project engaging, but several pointed out that while project work at university can be made realistic to a significant extent, '. . . it's still not real'.

When asked about aspects of project work they felt were less realistic, many comments were to do with scale and scope. While the project might be realistic, with a real site, there was too great a variety of work for a small group to achieve realistic outputs.

> 'It's real in the fact that it's a real building and it's real information that we were given, but you know in the back of your head that it is not going to work like this – there's not going to be nine people designing the whole building in the space of three months.'

Some students felt there was too much freedom for the assignment to be considered realistic.

> 'Here, it's design what you like—in reality you wouldn't have that freedom'

The open-ended nature of the brief was considered by some to be unrealistic.

> 'They [full-time students] will come out of the project thinking oh yes I'm competent I can do a drainage design, they'll get this idea that real project work is like you start with a clean piece of paper . . . it's not usually like that . . .'

But some students saw an open-ended brief as a positive thing, taking them beyond workplace experience especially in technical areas.

> 'It's nice . . . it gives you the freedom to take a high level role that you wouldn't be able to take in the workplace at our level . . . start with a blank sheet and see a design through to completion, it's liberating . . . at work it's very piecemeal . . . you only see a tiny snippet'

The role of the client in this context was raised in several of the interviews, but the range of views confirmed that it is not possible to generalise on this topic. Some felt that clients would have very specific requirements, others gave an opposite view, '. . . clients are vague . . .' But it was pointed out by several students that the influence of a client figure featured more in their experience of projects at work than at university.

> '[in the real world] you'd have the client calling you at regular intervals to find out how you're getting on, to talk about issues'

> 'In industry you have the client interface . . . putting pressure on you'

Treatment of costing was generally considered unrealistic. Many of the students were clearly constrained heavily by budgets at work, and noticed that this was prioritised less in university projects.

Another area of discussion was the possibility that a brief might change as the design progressed. This was identified by several students as a fact of life at work and less evident at university.

> 'Brief changing happens a lot in the real world'

It was considered realistic that the university projects involved a mix of people, some of whom did not know each other before the start of the project. For the multidisciplinary project in year 3, students felt in general that the requirement to liaise and work with other disciplines added realism. The processes of responding to challenges and learning from mistakes were also considered realistic. Some identified working to deadlines and working under pressure as realistic, though others did not agree.

> 'I don't know if I'd agree with pressure – I don't think it's as pressured as you get in the workplace'

### *4.2 Team-working*

A topic of particular interest in the interviews was the extent to which the groupwork experience, in terms of working relationships between group members, was seen as realistic. There may be problems, but isn't that what it's like in the real world? There was some agreement with this view.

> 'At work we don't get to choose who we work with. Some of the guys we work with are absolutely the worst people on earth—we'd never choose to work with them . . . they're the cheapest, or they're the client, and that's who you have to work with, whether they pull their weight or not'

Certainly the students interviewed presented a mixed picture: not everything in industry is ideal in terms of teamwork.

> 'In industry you find that people generally do pull their weight—some don't'

However it was pointed out by virtually all the groups that there was a management structure in the workplace: that the boss could intervene if there was a problem in the team.

> '. . . when it gets really bad [at work] you have someone to step in'

Interestingly most admitted that this rarely happened, and there was some discussion about how issues are actually resolved at work. Many students described how they sort out problems for themselves by talking directly to colleagues even when they think the colleague is at fault. 'You'd just go and speak to him.' But when it was suggested that that was similar to the university project there was strong consensus that things were different at work.

> '. . . you have to act professionally at work'

Teamwork in the workplace was characterised as being moderated to some extent by the management structure and also by expectations of professional behaviour and professional motivation.

> '. . . in industry . . . you're all working on the same project, with a manager, getting paid'

Many of the students interviewed were emphatic about the difference between the attitudes of work colleagues and some of their team members at university.

> '[some other students] don't understand the consequences of falling behind'

> 'If you're in the real world and you're working for clients, you can't afford to miss deadlines'

Overall there was strong consensus that the teamworking environment at university is not realistic.

> 'At university we only ever lose a mark or two ... if you make a mistake . . . you've not cost your company a million pounds'

## 5. Future issues

The potential impact on engineering courses of part-time students with current industry experience, like some other aspects of academic-industry collaboration, is influenced by the economic outlook of the industry. During the period of economic uncertainty in the UK construction industry since 2007, numbers of part-time civil engineering students at Coventry University have been falling, from 40% of the cohort in 2007 to 30% in 2012. Also in the UK significant changes in tuition fees have taken place (in 2012) which affect both full-time and part-time students. In most institutions the fees have roughly trebled, from about £3000 per year to £9000 for a full-time year of study. Fees for part-time students have increased by the same proportion. At the same time, although many employers pay the tuition fees of the employees they sponsor to study part-time, a new opportunity has arisen for part-time students, because in the new system they can access student 'loans'. A recent study of part-time courses which included interviews with engineering employers [9] indicated that employers did not in general feel that the fee increase would transform their attitude to supporting part-time study, but might make them more selective about who to support. Most felt they would continue to support their employees by paying fees rather than expecting them to access loans.

Even with diminished numbers, part-time students remain a valuable resource, as discussed in this paper, and course teams must remain attentive to their feedback.

## 6. Discussion

Academic-industry collaboration can take many forms and a very valuable one involves students—

specifically part-time students with current industry experience. As we have seen through consideration of the literature, full-time students can learn from these part-time students in mentoring schemes or by means of a managed approach to group formation for project work which encourages full-time and part-time students to work together. Another of the benefits, the main topic of this paper, is that part-time students with current industry experience can be used as a sounding board on aspects of course delivery. This is especially relevant for aspects of a course that aspire to capture realism.

This study involved semi-structured group interviews with 52 students: 42 part-time students together with 10 students who had completed one year's work experience in industry. It aimed to use the perspective of these students to answer two questions. The first was 'How successful are we in our attempts to create realistic project work for students?'

The students feel in general that from their perspective the project work has been realistic in terms of technical content. This has been achieved through basing projects on a real site, using real data, and working with a realistic brief. Some students have felt that these projects are unrealistic in terms of scale and scope: in particular that the open-endedness of the brief does not correspond to typical experience in engineering practice. Other students have stated how much they value this open-endedness as an opportunity for development. In this sense the study exposes the possibility of conflict between creating some aspects of realism in project work and optimising educational benefit. Clearly educational benefit should take priority, and this is a matter for judgement by academic staff.

Aspects relating to costing and budgets in university projects were generally considered unrealistic, whereas working in multi-discipline teams was considered realistic. It was suggested that having the project brief change during a project would add realism.

There was much discussion about the realism of the team-working aspects of university group projects. It was felt that some problems of working with other group members might reflect the real world in the sense that practising engineers do not choose who they work with and that the quality of staff in any organisation varies. But there was strong consensus that the team working environment was not realistic because at work the environment is moderated by the management structure of the organisation and the fact that there are clear expectations of professional behaviour and motivation.

The key findings are summarised on Table 1.

The second question was 'what improvements should be made?'

**Table 1.** Summary of findings

| | |
|---|---|
| Realistic | • Technical content: real site, real data, realistic brief.<br>• Working in multi-discipline teams.<br>• General challenges of team working. |
| Not realistic | • Scale and scope of project.<br>• Costing and budget.<br>• Team working environment: no management structure or guarantee of professional behaviour by colleagues. |

Several students in the interviews pointed to the absence of a 'client figure' as unrealistic. In some engineering courses this is a strong feature in the design of realistic project work, but clearly at Coventry, in civil engineering, there is an opportunity to develop this aspect. It would seem that there are two potential benefits: one is that it would make project work more realistic and the other is that it would improve teamwork by providing moderation.

More generally, the responses of the students, as detailed in this paper, should be considered when aiming to create or enhance realism in project work. The important areas are technical realism, the balance between realism and open-endedness, costing and budget aspects, multi-discipline groups, possible changes to the brief during the design process, a client figure, and the team-working environment.

## 7. Conclusions

Where engineering courses include students with current industry experience studying part-time, course teams should take advantage of the valuable opportunity for feedback on course design that these students offer.

This paper has described a study in which these students' perspective on the realism of project work has been sought in the context of civil engineering courses at Coventry University, UK.

The students felt that realism in technical content was generally achieved, especially when projects were based on a real site, using real data, and working with a realistic brief.

Realism was achieved in terms of the general challenges of team working and the experience of working in multi-discipline teams. But the team working environment was not realistic because the management structure of the workplace was not recreated and professional behaviour by colleagues could not be assumed.

The comments (in section 4.) and the discussion (in section 6.) provide useful pointers to enhancing the realism of engineering project work in university courses.

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