Cognitive apprenticeship meets industrial apprenticeship
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Abstract
On civil engineering courses at Coventry University, the presence of two types of student with relevant work experience has allowed a study of realistic project work to take an interesting perspective. The students are: (1) part-time students in the workforce, who study on day-release, and (2) full-time students who have spent a year-out sandwich placement in industry. Semi-structured group interviews with a total of 52 students have been carried out by four members of academic staff in such a way that no member of staff has interviewed students they are currently supervising. The students felt that, in general, the projects were realistic. They benefited particularly from working in areas (mainly technical) that did not correspond to their work area. They indicated that many aspects of the group working experience were not realistic, mainly because of the management structure in the workplace and the professional standards expected.

Keywords: realistic projects, part-time students, sandwich placements, professional attributes

Background
The context of this project is the MEng/BEng in Civil Engineering at Coventry University. About 30% of students in any particular year are part-time students in the workforce. They study on day-release and are taught and assessed together with full-time students. Most have had several years’ industry experience. It is clear from their performance on the course, including realistic project work, that these students have already acquired many of the attributes and behaviours of practising engineers, within what has similarities to an industrial apprenticeship.

Another relevant group of students at Coventry are those at level 6 who have returned from a one-year industrial “sandwich” placement and have experienced different opportunities for developing work-related attributes (typically between 20 and 30% of full-time students).

The course includes several significant group projects in which students work on realistic briefs. For example, at level 2 (full-time level 5), students work on a feasibility study for development of a brownfield site, based on an actual location, and on a structural design project with a brief from industry, and at level 3 (full-time level 6), students of all disciplines in the department work in multi-discipline teams on a realistic design and construction project, with a brief based on a real case which is supported by inputs from practitioners and real site data.

Rationale
The Royal Academy of Engineering has stressed that ‘universities and industry need to find more effective ways of ensuring that course content reflects the real requirements of industry’ (2007) and has presented case studies of ‘experience-led engineering degrees’ (2010). Many researchers have referred to the processes by which engineering students develop the attributes of practising engineers. Lindsay et al. (2008) 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 (2011) use the educational concept of “cognitive apprenticeship” (Collins, 2006) in supporting the development of engineering students’ use of authentic practices in a way similar to craft apprenticeships. To achieve the same objectives, the civil engineering courses at Coventry University (in common with other engineering courses) include elements of realistic integrated project work in every year, examples of which have been described above.

An interesting perspective on these concepts is provided by particular groups of students at Coventry University: the part-time students in the workforce and those at level 6 who have returned from a one-year sandwich placement.

The study is intended to provide insights into the development of professional attributes, the value of realistic project work at university and the experience of students who have already developed professional attributes to some extent. We seek to answer the following specific questions:

- What are part-time and sandwich students’ reactions to realistic project work? To what extent do they feel it creates the experience and challenge of a real project, including team-working aspects?
- To what extent have these students already developed the professional attributes that realistic project work, in part, seeks to develop?
- How have they acquired them?
- If they have already developed professional attributes to some extent, do they find value in this type of work?

The methodology

Our investigation was based on semi-structured group interviews with part-time students and those who had taken a sandwich placement. The groups are shown on Table 1.

We aimed for a group size of four, but this was not always achieved because of the size of the different cohorts and last-minute changes in availability. We chose to interview students in groups for three reasons: to achieve efficiency, to promote discussion and to offset any power issues between staff and students. We felt that students in groups would be less likely to tell interviewers (known to them as lecturers) what they wanted to hear; however, we wanted to retain the structure of an interview, as opposed to the more open but potentially less controlled atmosphere of a focus group (especially as four different members of staff were involved).

Table 1. Interview groups

<table>
<thead>
<tr>
<th>Level</th>
<th>Number of groups interviewed</th>
<th>Number of students in each interview group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part-time</td>
<td>2</td>
<td>2, 3, 2</td>
</tr>
<tr>
<td></td>
<td>2/3</td>
<td>5, 2, 5, 4</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>4, 4, 3</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>4, 4</td>
</tr>
<tr>
<td>Sandwich</td>
<td>3</td>
<td>4, 4</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>TOTAL</td>
<td>15</td>
<td>52 (42 pt; 10 sw)</td>
</tr>
</tbody>
</table>

The students interviewed (42 part-time and 10 sandwich) represent well over 50% of the available students. We wanted to have a relatively large sample and for all four researchers to have the opportunity for significant involvement in interviewing.

One member of the team (John Davies) coordinated the project. The three other members of academic staff involved have a heavy involvement in realistic project work across the years of the course. We wanted those involved in project supervision to hear from the students directly, thus interviewing was shared between the four members of the team. It was possible to distribute the groups so that no member of staff interviewed students who were engaged in project work under
their supervision at that time. Interestingly, one member of the team had been a part-time student of civil engineering at Coventry University (with 20 years’ industrial experience intervening) and one had been a sandwich student at Coventry (with four years’ industrial experience).

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. Further thematic analysis of the full data set was then carried out. Because of the imbalance in numbers we did not give emphasis to comparing the views of part-time students with those of sandwich students; however, attention is drawn to some significant differences.

**Lessons learned**

The students felt that, in general, the projects were realistic. They considered that this realism was achieved through basing projects on a real site, with real data, using a realistic brief.

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, ‘it’s still not real’.

When asked about aspects of project work they felt were less realistic, many comments were concerned with scale and scope: ‘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 that there was too much freedom for the assignment to be considered realistic, although conflicting views on this issue will be presented later: ‘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’.

Teamwork aspects were also identified as being unrealistic. This is also examined as a recurring issue later: ‘The project itself is quite real but working within a team I think is very different at university than it is in industry’.

An explicit aim of the realistic project work is to develop professional attributes. So, how do part-time and sandwich students, who may have developed these attributes through work, benefit from project work? The most common benefit identified was in technical aspects:

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Part-time and sandwich students were very aware of what they saw as a lower level of professional attributes among full-time students in, for example, time management: ‘If you’re in the real world and you’re working for clients, you can’t afford to miss deadlines’.

They also found that full-time students were not good at accepting criticism: ‘When you’re in industry someone will say – ‘this is OK but you need to improve it by doing such and such’ – and then you don’t take it personally; while sometimes [at university] especially last year in the integrated project someone would produce a piece of work and then you’d be trying to help them by saying – ‘this is OK but if you were doing this professionally or whatever I advise this’, and they’d almost take it personally’.

A topic of interest during the interviews was the extent to which the group work 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’. However, it was pointed out by virtually all of the groups that there was a management structure in the workplace; that the boss could intervene if there was a problem in the team. Interestingly, most admitted that this rarely happened ‘because you have to act professionally at work’.

Some students described potential sanctions in which a colleague might be reported to the boss, but others indicated that they could sort it out themselves: ‘Group dynamics are hard no matter where you are, if you’re at university or at work’. So is there much difference between the two environments? All groups felt strongly that there was: ‘In industry […] you’re all working on the same project, with a manager, getting paid’ and ‘At work I never came across a situation in which someone said ‘do this’ and it wasn’t done [...] You can’t say to your project manager: ‘sorry I didn’t feel like it’.

Is there potential for full-time students to learn from group members with industry experience during group work? Some part-time students recognised this and welcomed it: ‘Part-timers should pass on what they know’. Part-timers may naturally take a leadership role within a group of less experienced full-timers. This was identified by some as a benefit to themselves, especially as many part-time students do not have a leadership role at work: ‘Particularly people of our experience – you don’t get a chance to lead anything [at work]’. However, this was not welcomed by all part-timers: ‘With the workload we’ve got at the moment at university, sometimes managing people takes so much time it affects your other modules’.

Interviewees also recognised the potential disadvantage to full-timers that they might miss out on some of the challenge of project work by relying too heavily on part-timers to take the lead: ‘Full-timers will benefit more from working with other full-timers, so if they’re struggling through […] they have to pull their weight, they can’t rely on us’. Balancing numbers of part-time and full-time students in a group is a possible solution here: ‘When there’s more part-timers you feel more comfortable that you can then get the other full-timers to work with you […] last year we were on our own […] we felt a bit out of place [trying to influence how the work was done]’. This is a sensitive area for part-time students, mainly because of assessment: ‘I like doing group work and I like doing these sorts of projects. I just don’t want to be marked as a group’.

**Evaluation**

The study has provided some fascinating and useful insights, summarised below.

A particular strength of the methodology used for this project has been that four investigators, with a strong interest in a particular topic, have been able to contribute without interviewing their own students. Of course, we cannot claim that there is no bias, but there has, at least, been a balance between the four members of the team. A weakness might be that two of the four had limited experience of interviewing at the start, although they have benefited from the project by gaining experience.
Discussion, summary

We feel that the main points to emerge from this study are:

- University projects that are based on real scenarios and real data are considered by those with good knowledge of the industry to provide a realistic experience.

- To make projects practicable in a university setting, some loss of realism in terms of scope and scale may be inevitable. Some part-time students feel that freedom and open-endedness may affect realism, but others thrive on this because it contrasts with their daily work.

- Students with industry experience benefit more in terms of technical development than development of professional attributes, which they consider they gained in the workplace. Sandwich students are more likely to recognise personal development at university.

- Professional attributes are significant in this context because they define the difference in the way in which students that have industrial experience contribute to group work compared with those who do not. However, those who have already developed professional attributes do not find project work less valuable.

- Problems in working with other group members may reflect the real world, but the circumstances are not realistic. This is because of the management structure present in the workplace and the professional behaviour expected as a matter of course.

- Part-time students may develop leadership skills when working with full-time students that they do not develop at work. Some welcome this while others do not. This is a sensitive issue because of the link with assessment.

The study has provided the staff team involved with realistic project work in civil engineering at Coventry with some reassurance and plenty of ideas for future development.

Further development

The findings of this work will be combined with a separate study of how full-time students can learn from part-time students (Davies and Rutherford, 2012). This work is ongoing. We then intend to publish the findings more widely.

At a practical level, project work within the department is being given increased emphasis in a new course design and the findings of this study will be very relevant in guiding this development. Various changes will be implemented, at the earliest opportunity, in the projects that are the focus of this study, including more involvement by a “client” figure to support coordination within groups and ensuring that, where full-time and part-time students work together, there are at least two part-time students per group.

References


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