Student Projects: Preparing Future Engineers through Collaboration with Industry

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Abstract: As part of the HE STEM Programme, here at the University of Exeter we have been researching how to improve the projects we run in collaboration with industry for our third year engineering students. We have found that students participating in work that is of importance to a company – and could have a demonstrable impact in the “real world” – can not only improve their employability, as would be expected, but can also help motivate them to work harder and exceed their own expectations.

However, interviews with students who undertook projects involving industry last year and their academic supervisors have revealed a common stumbling block that is difficult to overcome within the time constraints of the traditional academic year: intellectual property. Many companies in the South West are small or medium enterprises and it may not occur to them – or, indeed, to the student – that they need to sign a contractual agreement in advance relating to intellectual property for such a low-level engagement. Of course, not all projects would result in an outcome that would require legal documentation, but of those that did, the timescale of the project was insufficient to resolve these issues satisfactorily. This generally resulted in the student needing to alter their work to avoid the problem, to the detriment of their project.

We hope to streamline the processes used in engaging with businesses for student projects – in particular, to embed a culture of establishing guidelines before a project is underway, in order to avoid problems later on.

Introduction

Employer engagement within the undergraduate Science, Technology, Engineering and Mathematics (STEM) curriculum is an effective means of improving students’ employability skills, (Morgan & O’Gorman, 2011), but it can also provide contextual relevance, experience of cross-disciplinary applications and opportunities to learn about the workplace (Velay, 2011).

Admissions officers at the University of Exeter are increasingly questioned about opportunities for industrial experience by potential students, who see departments who run such activities as having “an edge” over those who do not (Initial Results). Engaging with organisations through student projects is one way that the College of Engineering, Mathematics and Physical Sciences (CEMPS) satisfies these demands.

However, industry-linked student projects often require much greater resources, such as time and funding, than theory-centred projects (University of Cambridge, n.d.). For example, industry visits, the time spent brokering an agreement between the university and industrial partner, and the industrial
contact's time are all factors that may require additional resource and need to be taken into consideration for an industry-linked project. There are also other risks, such as university reputation (NCCPE, 2010) to consider. If difficulties arise mid-project - particularly disagreements regarding intellectual property (IP) - this could leave a negative impression on the industrial partner. As such, they may be reluctant to participate in a repeat engagement. Clearly, while student learning, performance and development are key motivations for project success, there are other factors that incentivise this further.

This research was undertaken as part of "Projects without Borders - Understanding how employer-led undergraduate projects differ in STEM disciplines" - a sub-project of a wider regional HE STEM project. One main objective was to understand the barriers to completing a successful industry-linked project from a university perspective and to develop resources to mitigate the effects of these barriers.

This paper addresses the issue of intellectual property in undergraduate industry-linked student projects at the University of Exeter using examples highlighted in our research, and seeks to outline the steps taken to prevent similar difficulties occurring in future.

Background

The motivation for this project arose from the possibility of new, industry-focused programmes being developed within CEMPS and a need for clarity and guidance in working with employers in different situations.

Identifying the main "stumbling blocks" to engaging with industry on undergraduate student projects was proposed as a way to understand the challenges facing staff and students working with industry. From this, we hoped to provide relevant guidance that was comprehensive enough to provide clarification on how to deal with the most common issues, but simple enough to ensure that the recipients were not overwhelmed with information.

Difficulties relating to intellectual property have arisen in undergraduate industry-linked projects in universities around the world (Glasspool & Dyer, 2011), (Magleby, et al., 2001), (Austin & Fitzgerald, 2008) – although the terminology for these ranges significantly. There is a variation in the perception of risk in different assessments of the dangers intellectual property poses to projects. For example, a statement such as: 'Projects based on verbal agreements and honourable intentions do not require formal IP agreements and are likely to be easier to implement' (Glasspool & Dyer, 2011) may be seen by some as downplaying the risks of engaging with business without a formal agreement. In contrast, implementing a system where each project must obtain a legal agreement relating to intellectual property could be perceived as overly bureaucratic and intimidating to academic staff members wishing to start working with industry for the first time.

During the project, we aimed to uncover the circumstances faced by those who had encountered problems with intellectual property, how each problem was dealt with, and what the impact of those actions were. Our intentions were to determine a minimally-intrusive yet effective set of guidelines, striking the right balance between protection and project freedom.

Methodology

Initial Stages

At the University of Exeter, third year engineering students must participate in an individual research project, which may or may not have an industrial element. Students undertaking the MEng four year degree course then continue on to complete a group research project in their final undergraduate year - again, this may or may not contain an element of industry participation.

We chose to research the industry-linked projects undertaken by third year undergraduate students primarily due to the fact that the majority of engineering students at the University of Exeter - usually over 70% - continue on to study a fourth year to achieve an MEng qualification. This meant that we were able to engage with the students - yet to graduate - after they had completed an industry-linked project, and could obtain reflective accounts of their experiences. The compulsory nature of the
research projects meant that we were also able to ask students for comparisons between the third year individual projects and fourth year group projects.

Student projects from engineering were specifically chosen due to the comparatively high level of existing industry engagement when contrasted against other disciplines within the College of Engineering, Mathematics and Physical Sciences (CEMPS). Out of 97 possible projects, over sixty percent (60.8%) had identified some form of industrial link: 33 had some possible industrial interest identified, 15 had a company who were interested in the results and had a named contact within that company, ten were either set by the industrial partner or sponsored the student, and one project was set by the industrial partner with support funding. 38 projects were identified as having no known industrial link.

Our project looked at student projects from a university perspective, namely from the staff and students themselves. We used three main methods for data collection: questionnaires, one-to-one interviews and forum-style meetings.

We used questionnaires to acquire a snapshot of students' opinions on a wide range of subjects, including:
- The relationship between the industrial partner and student;
- The benefits of the project (as perceived by the student);
- The project successes;
- The project challenges;
- Implementing the project;
- Dissemination.

These were given out in a lecture in October 2011 where all attendees were students who had participated in an individual research project the previous year. It was felt that distributing the questionnaires during a lecture and asking for them to be completed immediately would accomplish a greater level of student involvement than asking for the students to take the questionnaire away and return it later.

As it seemed unlikely that we would capture the interest of academic staff through questionnaires, we instead interviewed project supervisors. We were able to interview three Senior Lecturers and an Associate Professor - all experienced in supervising student projects - to gain an insight into the staff perspective. The interviews were structured to enable comparisons to be made between the responses given by the students and the project supervisors.
Initial Results

Thirty-five students - out of a possible seventy - had completed and returned the questionnaire. However, only ten of these students had carried out projects with a recognised level of industrial involvement with eight of these students fully completing the questionnaire.

The issue of intellectual property was raised during the questions relating to dissemination and project challenges in the supervisor interviews, but not through the questionnaires filled out by the students. In questions relating to publication and ownership of results, students had simply rated how strongly they agreed or disagreed with given statements, such as 'The student was encouraged to publish the project outcomes'. There were no qualitative responses to this section via the questionnaires.

However, with the supervisors, questions were asked in a more conversational setting, allowing them to expand on each topic in greater detail than would be allowed by a quantitative questionnaire. When asked about publications arising from student projects, two of the supervisors stated that they had had difficulties in dealing with intellectual property for student projects. For example, one supervisor talked about the issue of a sudden need for IP consideration part-way through a project: 'If IP comes up unexpectedly we have to then backtrack...certainly that is a pain in the neck for me'. Another supervisor commented on the disparities between the timescale of the project and the timescale of resolving legal disputes, such as intellectual property, formally. The supervisor complained that it could take 'months and months' to effectively solve problems with IP and nondisclosure agreements (NDAs) in student projects.

One of the student project supervisors also noted that, during their time as an admissions officer for CEMPS, they had perceived an increase in the number of students asking about the opportunities for collaboration with industry. They felt that giving the students the chance to engage with industry during student projects would not only benefit the students, but could also serve as a draw to prospective students who would see Exeter as having an edge over other universities that may not offer such engagements.

Redefining Focus

Intellectual property had revealed itself to be a key factor in the success of projects (Initial Results) so we decided to undertake in-depth interviews with students to investigate whether they had experienced similar issues. We also hoped to gain deeper insight on other factors aside from intellectual property.

The eight students who had identified a clear industrial link in their project work and had completed the questionnaire were contacted directly and offered the opportunity to talk further about their project, including what was successful and what they felt could be improved. Three students participated in the in-depth interviews.

Responses and Analysis

One student talked about how they were unsure where they stood in terms of IP. At the University of Exeter, students generally own the intellectual property rights to work they create and this holds true for their research projects, unless they have agreed otherwise with their supervisor and industrial partner. However, this student was under the impression that the university may take ownership of their ideas - or the ideas given to them by the industrial partner. The student voiced concern that they felt they had no claim to the industrial partner's ideas, as they may not want them used by the university without prior consent.

Another student mentioned that while he had not encountered problems with IP during his individual research project, he had participated in a summer placement in industry where intellectual property may have been an issue if he had wanted to publish his work. He felt that as the company he worked for was part of the supply chain of a multi-national company, it was likely that he would have been unable to publish any of his results, as they highlighted a flaw in a product used by the multi-national company, and this: '...wouldn't be good for marketing from their perspective'.

The third student had not experienced any problems with intellectual property directly, but was unsure about the processes involved in publication, and whether his classmates who had gone for publication
had been hindered by IP or nondisclosure agreements.

These student responses showed a general lack of awareness regarding how intellectual property is handled in student projects. The responses from the academic supervisors indicated that, while IP and nondisclosure agreements may not always be necessary, the difficulties that ensue if issues do arise can be very difficult to resolve within project deadlines.

To address these issues and to gain further insight, a departmental forum-style meeting took place.

**Forum Meeting**

Two Lecturers, a Senior Lecturer and an Associate Professor from Engineering attended the forum meeting, alongside academic staff members from Mathematics, Computer Science and Physics. The purpose of a multidisciplinary approach was to share best practice among staff within the College who were either already incorporating industrial engagement within their modules or planned to do so in the near future.

A ‘baseline’ intellectual property and nondisclosure agreement to be completed before work began on each project was suggested as a potential solution, but was rejected by several meeting participants. Arguments against this idea included: ‘this would not be good enough, nearly every legal issue needs to be discussed with the legal department and have something tailored drawn up’, ‘companies often want to modify it, which can lead to delays’ and ‘I don't want to insist on using contracts for every single project in advance, as most of them don't need it’.

There was also discussion on where the delays in resolving a legal dispute lay, with one staff member stating that many of the delays he encountered were on ‘the business side’, while another staff member countered this with a statement that, in their experience, most delays were caused by the university. Following on from this, we learnt that each person who had interacted with the legal department to resolve issues had done so on an individual basis - there was no existing general process in place. It was also mentioned that staff ‘do not have the time to get passed around between departments, as seems to be the current case’.

The issue of a lack of awareness regarding IP on behalf of the students was raised, with staff members from disciplines beyond Engineering stating that their students were averse to working with industry as they were unsure of their rights in this respect. An Engineering Senior Lecturer shared that his third year students had been given a talk on IP by a member of staff from Research and Knowledge Transfer, which had clarified such rights.

A final point that was made was whether students' final reports have to be stored in a public archive upon completion, as some project data may be too sensitive for immediate publication, or could potentially violate an IP agreement if the report was made available in this way. There was some uncertainty over whether the placing of project reports in this repository was mandatory.

**Results and Discussion**

The key points - relating to intellectual property - raised by students were:

- An uncertainty regarding ownership of ideas and outputs;
- Concerns that ideas and outputs may be used inappropriately or without permission;
- A preconception that publishing results may be more difficult if the industrial partner is part of a supply chain;
- Uncertainty regarding the processes involved in publication;

The key points raised by academic staff through interviews and the forum meeting were:

- Difficulties in resolving legal issues in the short timeframe provided by student projects;
- Disruption to project work caused by problems relating to intellectual property;
- A template IP and nondisclosure agreement to be used in every industry-linked student project would be impractical;
• Delays in communication were encountered from both the industrial partners and from the university legal team;
• Lack of available time to deal with IP was a particular issue for academic project supervisors;
• Each supervisor had to contact the legal department on an individual basis if they encountered issues with IP;
• Some students were averse to working with industry as they were unsure of their rights to IP;
• Talks on IP could be delivered to students by Research and Knowledge Transfer;
• It was unclear whether storing project reports in a public archive was mandatory or not.

To provide effective solutions for these issues, considerations had to be taken into account. These included the restrictions of time available to academic staff to implement new systems, the availability of staff members outside Engineering to assist in providing these solutions, but above all, ensuring that the resources created were valuable to the staff and students and would not be overlooked.

The student IP talk held by RKT for third year Engineering students was looked upon as an example of best practice and RKT were contacted to determine if they could provide a similar service to other students, both within and outside Engineering. They agreed that this would be possible as long as suitable notice (one month) was given. The contact details for this RKT staff member were passed on to all parties who had shown interest at the forum meeting. The content of the student IP talk has previously focused on informing students of their intellectual property rights in terms of the work they create as part of individual and group research projects. Students also have the opportunity to ask any questions they may have, such as where they can obtain impartial legal advice, and it is envisioned that answers to popular queries will be included in later talks.

An intellectual property briefing document has been prepared by the legal team, with advice on how to deal with common disputes and key factors for consideration. It also aims to highlight which projects are likely to require legal agreements in advance, so that IP issues are less likely to arise unexpectedly once a project has started. This has been disseminated to all staff members within CEMPS that have expressed an interest in undertaking engagement with industry, to provide a measure of guidance and support.

From September, a specific staff member within the College will take on the responsibility of communicating with the legal team in relation to student projects. This will provide a central contact and a more formal process for those unsure how to resolve IP difficulties in student research projects. They will not be responsible for dealing with formal research contracts.

A checklist is being developed as part of the wider project to ensure that project supervisors consider all factors that may majorly affect the success and quality of their students' projects. As part of this checklist, it will include five checkpoints relating to intellectual property and other relevant legal considerations, taken from the briefing document. These five checkpoints (wording subject to review by senior management) are:

• “There will be no formal visits to the industrial partner. OR Who has responsibility for the health and safety of the student(s) during any visits to the industrial partner has been established.”
• “All aspects of the project are based within England or Wales. OR The project has aspects based outside England or Wales, but the project is compliant with relevant policies and procedures.”
• “It is not expected that the university will generate intellectual property (IP) as part of the project. OR Intellectual property is expected to be generated, but an agreement is in place to deal with this.”
• “The university will not be exposed to existing IP, owned by the industrial partner, that needs to be protected through a nondisclosure agreement. OR A nondisclosure agreement is required and has been completed.”
• “The financial risks have been considered and the University’s financial liability is limited.”

The checklist will be used as a way to review project suitability and will be included in the mandatory student project assessment that occurs before students are offered project options.

Conclusions

The view that dealing with legal processes for collaboration with industry can be lengthy and time-consuming is backed up by previous research, such as one US study that found: “Negotiation, contracts, licensing and lawyers in general only cause headaches for most university scientists” (Baca, 2006). The role of the project in streamlining and clarifying these processes as far as possible should
contribute to fewer projects seeing excessive disruption and modifications due to disputes over intellectual property.

The decision to embed the checklist within the student project assessment process was taken for two reasons: firstly, this would reduce the workload significantly for assessors, as they would no longer need to undertake in-depth analyses of each project, but could instead see an overview of where the project meets the set targets.

Delegating a staff member within the College with the responsibility of being an intermediary between the legal team and College staff was important due to the difficulties in communication between departments in such a large organisation. Earlier research highlights such difficulties, finding that: "breaking down the silos within their [academic staff] institutions as a particular aspect of culture change needed for effective EE [employer engagement]. Improving communication between the centre and departments was also important" (Bolden, et al., 2010).

Providing staff engaging or planning to engage with industry with practical legal guidance was important as the forum meeting and interviews revealed a lack of awareness regarding the correct processes involved in dealing with intellectual property for student projects. IP talks held for students should address a similar issue: a lack of awareness regarding their rights to intellectual property.

This work highlights that engaging with industry for student projects may be more complicated than expected when intellectual property becomes an issue. Time played a large role in several of the cases discussed, with academic supervisors and the legal team struggling to resolve IP and NDAs before the project came to a close – sometimes leading to the unwanted modification of project outputs to protect the student. This demonstrates the need to take reasonable action in advance if a project seems likely to require legal documentation, and to have clear processes and support in place to deal with issues that may arise unexpectedly.

References


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