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Joined Up Thinking?

A Review of the Impact of a Higher Education and Industry Partnership on Undergraduate Product Design Students

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Abstract

The aim of this paper is to provide educators and potential industrial partners with an insight into student perceptions of working with industry during their programme; and, highlight, through comment from academic staff, the effect on their design outcomes. This paper focuses on a collaborative design activity conducted with second year product design students within a Higher Education Institution (HEI). The study is part of ongoing pedagogic development of a module and programme relating to design practice. The study covers two academic years, where one year the design brief was based on a review of literature and the second where an industrial partner provided the information. Academic staff and industrial partners were interviewed. Students completed a survey regarding their experience and perception of working with the industrial partner within the module. The results indicated that there were significant improvements in student engagement, academic grading and the perceived quality of the final design outcomes. The results also showed that students not only saw industry collaboration as an essential element in their undergraduate learning but also that it was a key factor when deciding which programme they chose to study.

Keywords: industrial collaboration, product design, higher education, pedagogy, live projects

Introduction

The restructure of the higher education sector in the United Kingdom by the Conservative Government in the early 1990s helped change the public's perception of not only which sections of society can benefit from a university education, but also arguably the purpose of such an education from a vocational knowledge acquisition activity to a focused pursuit in gaining the skills required for employment.

Industrial partnerships with universities as a whole has already been well-documented (Barnes, 2002), less well documented is the industrial engagement in live collaborative projects specifically in relation to product design higher education. Product design undergraduate education in its current form is a relatively new subject area which has its roots largely in technical colleges and post-war polytechnics (Powell, 2011). Due to its very nature, product design as a subject area and indeed a profession involves a broad range of skills drawn from a number of different disciplines. In recent years the scope of design has expanded still further and the established boundaries have blurred (McCullagh, 2010). A Product Designer must be a jack of all trades and a master of many (Hurn, 2006), therefore undergraduate teaching encompasses everything from lecture theatre based sessions, through to studio and engineering workshop. Engagement with industry for live projects broadens the student experience still further in addition to industrial placements and competition entry.

In the context of this paper, a live project for a product design undergraduate degree programme is defined as assignment work set by an academic who ensures that the academic standards and learning outcomes are met. Further to this the project is enhanced by allowing students to engage with professionals from industry on projects that are focused towards specific outcomes that relate to the company's product line or market sector(s). This closely mirrors Sara's 2004 definition of a live project which goes further stating that the process is more dialogic and inclusive than traditional studio projects. The external focus introduces a contingency to the projects, which makes live project work stand apart from the necessarily more abstract projects of the traditional design studio (Sara, 2004). The involvement of the company can vary considerably depending on a number of influencing factors on both sides of the partnership. On the company's side the availability of personnel, the cost implications of having staff out of the business for several days. The timeframe of the project, the on-going commercial viability of any outcomes and the complications of patent infringement and intellectual property rights all have their influence. Whereas the university's considerations are mainly centred on meeting the requirements of a predefined module specification and ensuring that the project fits within the time frame of the semester that the module runs in.

The research conducted for this paper seeks to acquire greater knowledge and understanding of the impact of such live industrial partner projects in the product design higher education sector and its development and implementation by academics and partner companies. More specifically the research focuses on the learning processes of product design undergraduate students and how contact with industry affects their performance and employability after graduation.

Do product design academics and students see live projects as a vital element of product design study that should be integrated into teaching practice? Or do they feel that live projects are an unnecessary complication? Further to this, is there any evidence that live projects can improve student engagement and performance? And does exposure to industry linked projects improve employment prospects for undergraduate product designers?

Literature Review

In recent years the higher education sector in the United Kingdom has undergone some radical changes. Lord Browne's review of student fees and finance has had a huge impact that has seen not only a restructuring of how undergraduate study is funded, but also a refocusing of how universities manage their relationships with prospective students (THE, 2010). Mass higher education and withdrawal of government financial support has created a shift in the balance of power in favour of the new student 'customer' (PEG, 2006). In a wider context, over the last two decades Bridges argues that almost every one of the boundaries which gave definition to a university and to students experience of it have been removed (Bridges, 2010). Teichler concurs that since the post-war era, higher education has shifted from a small educational 'elite' to mass education. Higher education policies in most Western industrial societies have become preoccupied with the training and selection function of higher education, whereas research issues and cultural enrichment has played only a secondary role (Teichler, 1988). Scott states that the transformation has been intense, the number of universities has doubled; they have become large and complex organisations; and they have taken on new roles. The number of students has quadrupled and as a result novel academic programmes, course structures and learning strategies have been developed (Scott, 1995). Slaughter and Leslie argue that changes have also been driven by universities trying to compensate for diminished government revenues through liaisons with business and industry (Slaughter, Leslie, 1997).

Some of these transformations have been arguably led by changes in the expectations of both parents and students with increased focus on the impact of programmes in terms of value for money, such as contact hours with academic staff, the transferability of key skills to the workplace and ultimately students' employability after graduation (CBI, 2009a). Boud and Solomon argue that innovative responses are required if university programmes are to remain relevant (Boud, Solomon, 2001). Barber states that the next fifty years could see a golden age for higher education, but only if all the players in the system, from students to governments, seize the initiative and act ambitiously. If not, an avalanche of change will sweep the system away (Barber, et al, 2013). Bridges concurs stating that linking higher education more closely to employment will help meet the needs of students to combine study with earning money (Bridges, 2010). A report from the 1994 Group of universities found that 80 per cent of students said future employability and salaries were a factor in deciding which university to apply to. This rose to 89 per cent when students were deciding which particular course to take (Baker, 2011). However, a survey undertaken by the Confederation of British Industry (CBI) showed that many recent graduates felt they had not received high-quality careers advice. Others thought more could have been done to help them develop the employability skills necessary to secure the jobs they wanted (CBI, 2009b).

The Higher Education funding Council for England (HEFCE) agrees that embedding employability into the core of higher education will continue to be a key priority of Government, universities and colleges, and employers. HEFCE argues that this will bring significant private and public benefit, demonstrating higher education's broader role in contributing to economic growth as well as its vital role in social and cultural development (HEFCE, 2011).

'The Future of Higher Education', a Department for Education & Skills (DfES) white paper in 2003 identified closer relationships between employers and academics as a critical factor to preparing new graduates for work and continuous professional development. The report goes further to say that at their best; these links should be highly interactive, with each partner well aware of what the other can offer, and of what their needs are (DfES, 2003). The Royal Academy of Engineering (RAE) stated in its 2007 *'Educating Engineers for 21st century'* paper that universities need to attract more students

and university programmes must recognise the changing requirements of industry and provide students with practical skills to work effectively in industry on graduation (RAE, 2007).

The historical context of such collaborations can be traced back as far as the Bauhaus with Walter Gropius's proposal for the establishment of an educational institution to provide artistic advisory services to industry. Gropius called for close cooperation between the industrialist and engineer on the one hand and the artist on the other (Droste, 2006) and spoke of '*the same spirit*' and '*oneness of a common idea*' (Gropius, 1931), philosophies that still echo in the creative disciplines today.

If we focus our attention more specifically at design graduates' skills and abilities, the design industry is keen to express its concern at the level of design graduates' understanding of the finer points of commercial design practice. Gadi Amit, famed designer and president of NewDealDesign, a strategic design studio stated that he was '*finding that the impressive academic credentials of most students don't add up to the basic skills I require in a junior designer*' (Amit, 2010).

Design commentator Don Norman goes further, '*We need a new form of design education, one with more rigor, more science, and more attention to the social and behavioural sciences, to modern technology, and to business*' (Norman, 2011). Butcher and Schaber argue that in undergraduate design, live client projects are enhancing the curriculum and challenging students with outside constraints and deliverables, furthering learners' professional knowledge (Butcher, Schaber, 2012).

Sara argues that live projects have the potential to provide a huge variety of outcomes in terms of student learning and whilst traditional studio projects are organised around 'manageable' projects, the live projects introduction of the 'other' – the outside influence – means that projects are inherently unpredictable, complex and open to contingency, meaning that the learning outcomes might be difficult to predict (Sara, 2006). Glasspool states that live projects not only provide a link between practicing engineers/designers and students, but also give students a deeper understanding for how they will use their discipline-specific knowledge and skills in industry (Glasspool, 2013).

Product design education at undergraduate level benefits from its practical, learn by doing nature. Programmes must expose students to a broad range of teaching and learning styles and approaches which mirror the design environments they are likely to work in (Hurn, 2011) and therefore has a stronger case than most for demonstrating positive impact by answering the demand from industry and in a wider context contributing to the growth of the economy.

Viljoen and Hoskyns 2007 study states that industry partner led projects can take four distinct forms with two defined ideologies, one being community and the other commercial. The community driven and commercially driven project ideologies are then broken down into projects undertaken outside of the academic curriculum and those within it (Viljoen, Hoskyns, 2007). In this context, the live project study focused on for the research for this paper is a commercially driven project within the academic curriculum of a product design undergraduate programme.

Further distinctions can be made in terms of specifics relating to product design live projects. Where there are three distinct types of project that a live element can be applied to. Firstly, final year 'major projects' are a consistently common element in undergraduate product design programmes (Hurn, 2009). They represent the culmination of a final year student's study and therefore are a major contributor to the student's degree classification. Secondly, 'design week' projects where individuals or groups of students are asked to create conceptual ideas in a limited time frame and finally individual module assignment based work, where the project could form only part of the content of the module and be implemented at any stage of the programme i.e. stage one, two or three.

It is the latter that is the focus of the research for this paper in that the study used is that of a specific product design second year cohort who were engaged in a commercially driven assignment based live industrial partner led project. Through the use of this specific project it was hoped that measurable data could be gained from all parties as to the validity of live industrial partner projects as well as highlight opportunities for other academics developing such projects in the future.

Background to the Research

The *Design Project Conception* module is undertaken by stage two BA and BSc Product Design students at the University of Derby in the autumn semester of a two semester year. The module is linked with the *Design Project Realisation* module that follows it in the spring semester. Both modules are weighted at 15 credits out of the total of 120 credits for stage two and so represent a sizable percentage of available credit for the academic year. The two modules expose students to the full range of design practice processes, from design research, ideation and design development through to final realisation for manufacture. This outline is, to a lesser or greater extent, representative of the processes undertaken by practicing product designers.

Design Project Conception centres on the research and ideation phase through to the production of a conceptual model with students working for the majority of the time individually to generate their own designs. For *Design Project Realisation*, students work in groups to develop four chosen concepts through to a realised, close to production ready product.

In previous years the modules project assignments have not been live industry led collaboration projects. The products that the students developed for the second module phase were selected by the academic tutor and subsequently purchased by the university in order for them to be disassembled for the students to investigate. However, feedback from students expressed a desire for industry contact in these modules, backed up by the programme's external examiner who stated that *'the practice of live projects is one that is appreciated by the student body and forms an important part of exposing students to "real" world scenarios'* (Hurn, 2009). It was therefore clear that links with industry must be not only maintained but strengthened to cement the integrity of the programmes, and that to enhance the student experience; an industry partner would be sought for these modules. This presented the author with an opportunity to measure the impact of a live industry driven project against the non-live project data from the previous year.

BabaBing Ltd is a Yorkshire based design led baby products company who specialise in change bags and baby bouncer products. The company design their products in the United Kingdom and

manufacture in China; therefore engaging in a fairly typical commercial design process that most students will be exposed to after graduation.

The company approached the author looking to involve students in a design competition that would provide fresh creative input for expanding the BabaBing brand into the lucrative infant highchair market. Representatives from BabaBing and the author met to discuss how the competition could be integrated into an academic assignment brief and it was agreed that the *Design Project Conception* and *Design Project Realisation* modules met the needs of both parties as BabaBing were specifically interested in working with the entire year group of twenty one second year product design students, who were all male, agreeing with the authors view that stage two was a good time to introduce live projects to students due to the combination of acquired skills and unbridled creativity at this stage in their design careers. The research project did not actively set out to gather data exclusively from male students; however this was the make-up of the cohort when the research was conducted.

The research for this paper focuses specifically on the *Design Project Conception* module phase during the twelve week autumn semester between September and December. During week one an initial presentation was given by the company Directors from BabaBing. This outlined the company's background from start-up through to the development of their current product range. The presentation went on to outline the specific highchair market, including an analysis of competing products, legislative guidelines for the students to consider as well as materials and cost implications. The students were also given a module assignment briefing document by the module leader that outlined the key deliverables, learning outcomes to be met and a timetable of the weekly studio and workshop sessions. With the exception of the company and product range outline, specific brand focus and insights from the company's experiences, the presentation and information mirrored as closely as possible the information and format the students had received in the previous year's session for the non-live project. Following the presentation, the first six weeks were spent in the design studio researching and developing the students' initial design ideas. During week's seven to twelve, students worked on their conceptual designs through the development of visual appearance models in a workshop environment. These models were then presented to representatives from BabaBing during week twelve.

Methods

The research for this paper was conducted in four phases using a number of discrete methods over a two year period.

Firstly, in order to gain a more general understanding of live projects application within the university, a pilot study was conducted to collect qualitative data from key academics. Previous live projects at the university were investigated with the assistance of staff from different specialisms, departments and faculties. This was facilitated by semi-structured interviews. Members of staff were asked to express their views and experiences of working with industry partners on live projects with a focus on the problems that they encountered integrating such projects into their programme modules' learning outcomes. The qualitative data obtained was analysed using a coding and clustering approach (Auerbach & Silverstein, 2003), common in qualitative research.



Figure 1. The four overall phases of the research project

The findings from the analysis of the data collected from the phase one pilot study were used in phase two of the research. This helped formulate the content and structure of the live project and required assignment brief document that would allow the author to conduct a comparative study (Norman, 1999) to gain further, more focused qualitative and quantitative data from the second year student cohort. This would be achieved through the university's official module feedback forms process as well as the outcomes of the student's formal assessment from both the live project and the

previous year's non-live project. This data would provide the author with a balanced overarching perspective of live projects in product design higher education.

Phase three of the research pulled together and analysed the different strands of quantitative data from phase two. This involved comparing the formal assessment data from the live project with the previous year's non-live project as well as data from a quantitative student questionnaire that was conducted after the project, allowing the students to reflect on their experiences.

The final qualitative research conducted in phase four enabled the author to triangulate an overview of the success of the live project via semi-structured interviews carried out with second year students and a separate one to one interview with the BabaBing Company Director. Open style questions were used to start the feedback process, allowing the students and the Director to express their views and concerns rather than any preconceptions that the interviewer may have had. The student responses were recorded and analysed by mapping each interviewee's perceptions on top of each other around corresponding issues relating to the live project itself.

Results

The initial pilot study conducted with academic staff before the main collaborative study phase found engagement with industry actively on the agenda of both the university at a strategic level and with academics within other faculties at programme level. This has gained momentum considerably in recent years as the university repositions the way that it presents itself to a prospective student customer who is increasingly focused on the endgame to their education, namely employment. It also became clear that contrary to popular perception and in line with the author's programme development study (Hurn, 2009), a larger number of companies were keen to engage with creative students during a recession as this provides opportunities for a type of controlled crowd sourced design providing a wealth of fresh ideas for a relatively small cost.

Academic Staff

Live industrial partner projects at the University of Derby outside of the product design department gave an indication of how narrowly focused the application of live projects was at the university.

Although the university had several notable industrial partnerships, providing tailored computer aided manufacturing qualifications for engineering apprentices from Rolls Royce Aero Engines, to engineering degrees for Kuwaiti oil company employees, support for involving companies in undergraduate teaching and learning was inconsistent and underdeveloped.

The Programme Leader of the textiles undergraduate programme at the University of Derby has headed up several live projects that have involved students creating designs for local businesses and international brands. The Programme Leader stated that: -

'All of the live projects I have undertaken with my students have been difficult to incorporate into the learning outcomes of programme modules. The rather rigid structure of the design of our modules and the fact that we inherit modules from other members of staff, as well as the lead times that are required to modify a module to incorporate a change such as a live project have shown that at present we're not really set up for it'.

The Programme Leader cited the main advantages of working with industrial partners as being relevance and fresh approaches, stating that: -

'Students and staff get a real buzz out of working with companies in their field. There's a sense of working on new fresh challenges and a relevance to what they see themselves as doing when they graduate that's impossible to get from the university alone'.

The Senior Lecturer in Imaging in the Radiography subject area has been working with the National Health Service (NHS) on live projects with her students for a number of years. The academic had a background in the NHS herself as a Diagnostic Radiographer and used her contacts there to help, a theme that seems common among academics setting up live projects.

'I contacted friends that I'd worked with to get the ball rolling. In my experience its left very much to the academic to draw on the network of people you may or may not have met during your time in the work place. Starting from scratch would be a real struggle, but the University of Derby does have more staff than the more established universities who have a practitioner rather than a research background'.

Fellow academics within the product design programmes shared their experiences of live projects that they had ran prior to the research for this paper, stating that: -

'most of the time the projects ran smoothly, although we did have problems with the availability of staff from the companies, some moved on during the course of the project, and if that initial contact is lost it makes it difficult to keep the students motivated if the company doesn't return to judge the work the students have produced'.

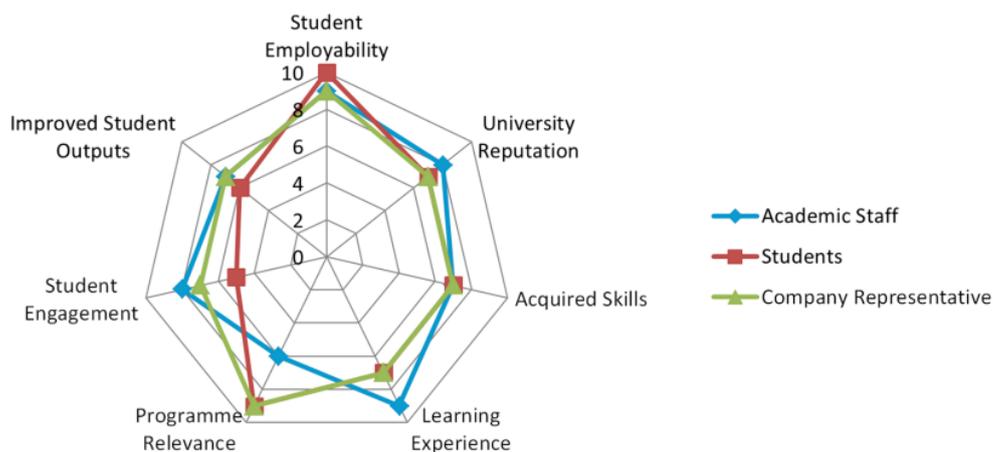


Figure 2. Pilot study of ten academic staff opinions regarding live projects overlaid with student and corporate partner opinions

As can be seen from figure 2, ten members of staff were asked to rate key aspects of the value of live projects to students alongside the benefits to the programme and the university. Factors that scored highest with staff were a perceived improvement in student employability, a broader learning experience for students and that visible connections with industry enhance the university's reputation.

Comparative Study

There were a number of key findings from the comparative study conducted during the twelve week length of the project during the autumn semester. Firstly, there was a notable improvement in student engagement throughout the course of the semester with full attendance for four out of the twelve weeks in comparison to only one week out of twelve in the previous non-live year.

Academic staff also commented on the significant improvement in the quality of the concept ideation (idea generation), model making and final outcomes stating that *'the work was noticeably more professional than in previous years'* and that *'students have said they feel like the pressures on and they don't want to look unprofessional in front of BabaBing'*.



Figure 3. Notable improvements from previous year example (left) in design refinement and visual appearance model (right)

Another notable outcome from the comparative study phase was the significant improvement in grade point average of the student cohort as a whole. As can be seen in figure 4, there was a significant shift up the grade scale in this live project year when compared to the non-live project that had been run the previous year in the same format but without an industrial partner.

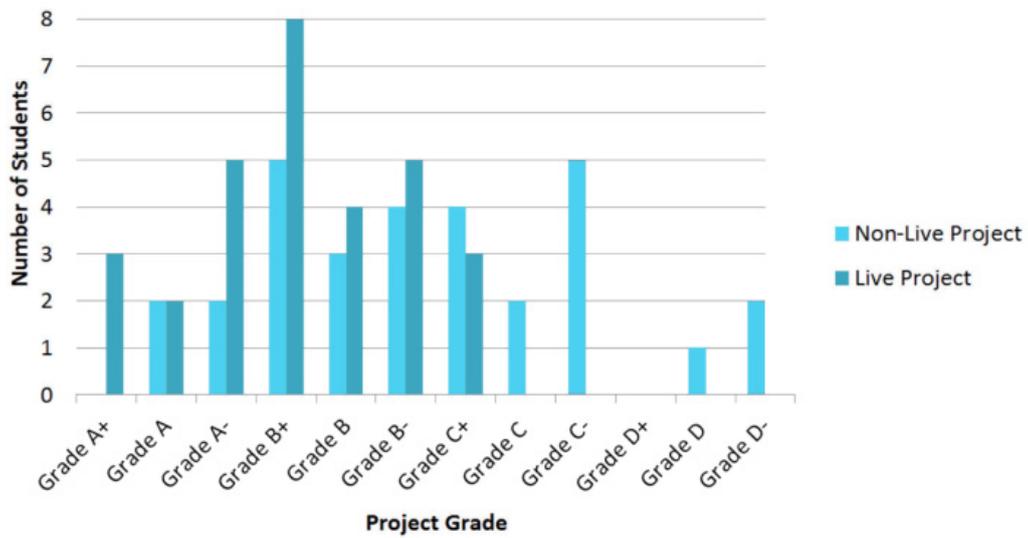


Figure 4. Notable improvements in grade point average over non-live project

As a result of this, there is also a significant drop off of lower grades, with the lowest grade achieved being a C+ as oppose to a D- in the previous year.

Students

The student’s responses to questions after the project were favourable as can be seen in figure 5, with 83 per cent of the cohort seeing industrial partner projects as an important element in a product design undergraduate programme.

65 per cent of students thought that the work they had created was of a higher standard than it would have been if the project had not been backed by industry. A 78 per cent majority thought that industry projects should be a core element of the product design programme. But perhaps most notable is that 92 per cent felt that working with industry improves their chances of employment after graduation.

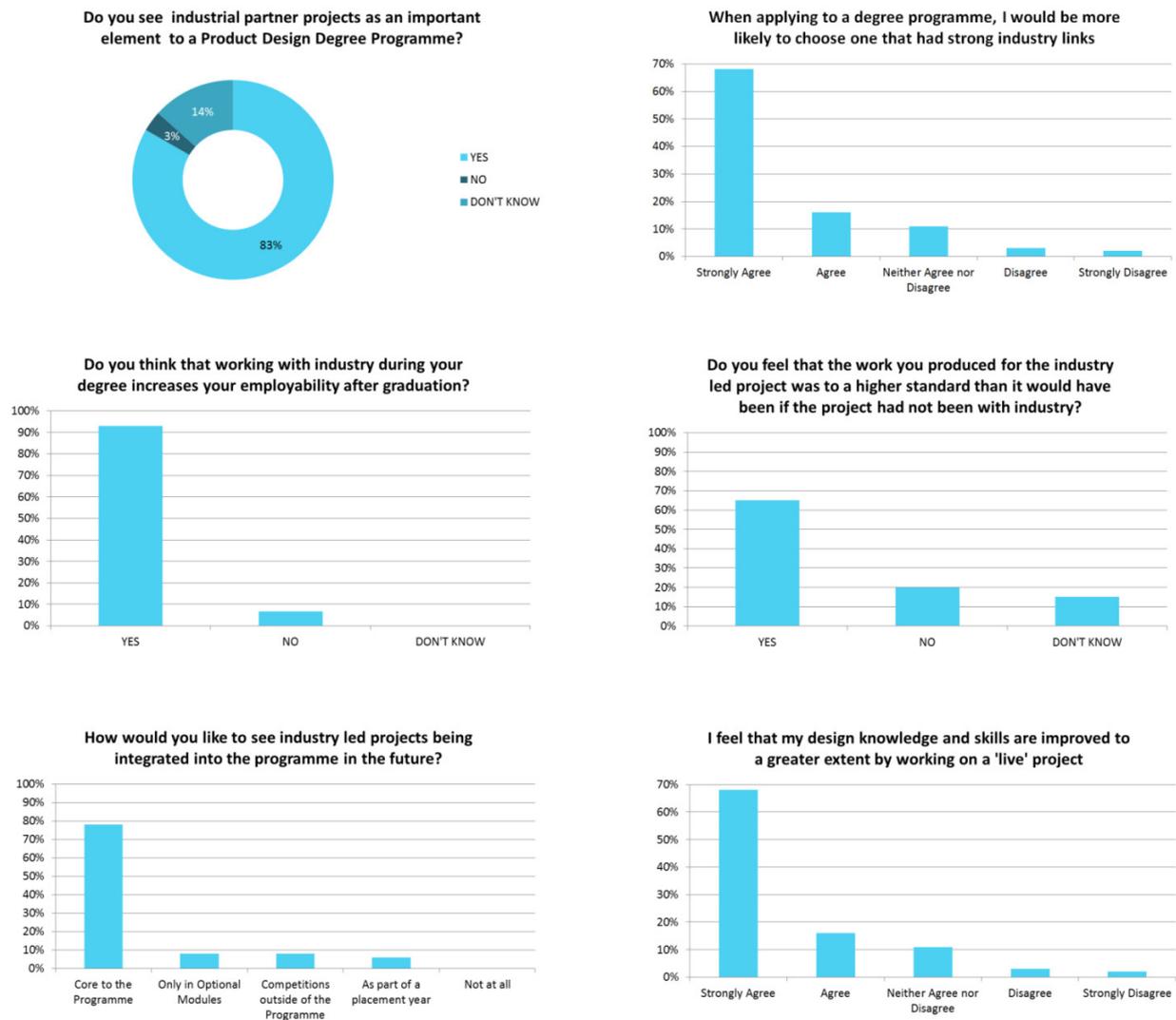


Figure 5. Data collected from product design students

When asked to comment, students were upbeat about the project, with one student stating that *‘as far as I’m concerned, where I’d come from a degree with no live element at all, I think both my engagement and resulting success were far higher when the project was based within a more “real” grounding’*.

Interestingly, a number of students also thought that they were more likely to seek a placement due to their experience stating that: -

‘It wasn’t something that I thought I’d be able to handle before; I didn’t think I was at the right level. This project showed me that I wasn’t, but I feel I am now from the work that I’ve produced and the feedback I’ve had from the company’.

Corporate Partners

The impact of the project on industry relations was very positive with the company stating that they were keen to continue the partnership in the future. The BabaBing company Director cited both the close collaboration and enthusiasm of the tutor and the quality of the work of the students as the key influences in this positive reflection. Further to this the company saw the upfront organisation, particularly in the clarity of the ownership of intellectual property as a key to the success of the collaboration on both sides of the partnership.

The company Director was asked to express his views regarding the success of the project, he stated that *'During our visit we certainly found each student took the brief seriously, and approached it in a mature and enthused manner'*.

The company Director also commented that *'It's so important [for students] to have experience of working closely with industry. There is no better period to grow as a designer and to be exposed to the commercial world, and understand the process from design to market launch'*.



Figure 6. Student Vit Fendrych (right) demonstrates his design proposal to BabaBing company Directors Ashley Robinson (left), Jamie Robinson (second left) and Nicholas Robinson.

When asked if whether or not a student designer had industrial experience during their studies would influence him or his company in employing a design graduate, company Director said *'Without a doubt, we're at the point now where it's practically essential for anyone we'd be taking on.'*

Research by the Engineering and Physical Sciences Research Council (EPSRC), one of the UK's largest research funding bodies, has stated that there is a tendency for companies to assume the role of mere observers, commenting on the work being carried out by academics (Barnes, 2002). Although this was partly the case during the course of the research for this project, this was primarily due to time constraints on the side of the university timetable and not because of a reluctance of the company to get involved. In fact, BabaBing staff expressed interest in being more engaged in the project in the future stating *'we'd be more than happy to come in and engage with the development process, if we can work with you to plan this up front I think we could get quite a lot out of that.'*

Discussion

The major findings of the research for this paper were primarily that there was a significant improvement in the students assignment grades and the perceived quality of the design outcomes when the project was run as a live project with the collaborative company. Further to this students expressed strong views regarding the importance of collaborating with industry while studying and had clear opinions on how this would influence their choice of university and programme.

The findings of the project, although by no means conclusive, show that live projects are increasingly an important element within modern product design programmes. They are being actively sought out by prospective students as well as being demanded by existing ones. Further to this it is quite clear that live projects have a notable impact on student engagement and performance. It is arguable that for the survival and relevance of product design programmes in the future, live collaboration must be written into the very fabric of programme design and development.

Similar studies such as Barnes 2002, Barber 2013 and Glasspool 2013 have found comparable outcomes but in different disciplines. These studies also highlighted the difficulties of running

collaborations citing ownership of the resulting intellectual property, engagement issues with collaborative partners and curriculum inflexibility as key barriers to the effective integration of live projects.

Possible alternative explanations of the findings could be that the difference in grades between the two year groups was due to the fact that they were different cohorts, and that improvements in attendance could be due to external factors such as engagement with other modules and assignment deadlines. It is clear from the views expressed by the students and staff that students were affected by the fact that the project was a collaborative project with industry, in that they felt the pressure to perform because of the company's involvement. However, it is unclear from the data collected whether this was due to the direct albeit limited contact with the personnel from BabaBing Ltd at the beginning and end of the project.

The limitations of the research centre on the fact that the cohort size was limited to twenty one male students. As a result of this, the academic grading data generated, as shown in figure 4, was of insufficient volume to conduct in depth statistical analysis. As well as this the comparative study between the two separate year groups as mentioned could have caused some of the differences in the data.

The academic grade analysis, although fairly consistent due to the same projects being marked under the same conditions by the same tutor during both years, could be considered to have bias or other inconsistencies. Further to this, some of the perceived improvements cited by the academics in the quality of drawing, model making and the overall design outcomes can be seen as conjecture with little in the way of hard evidence to support the claims.

There is scope for further research that could utilise a group of universities and product design programmes to spot similarities and patterns in a larger and broader collection of data. This would facilitate the data required for thorough statistical analysis as previously mentioned. Further research could also be conducted to gain insights into how to minimise the complications implementing live projects within existing and newly developed programme curriculum.

Conclusions

The original research questions posed at the beginning of the project asked if academics see live projects as a vital element of product design study. The question was also asked as to whether they should they be integrated into teaching practice. From the findings of the research for this paper there is a strong argument to say yes. They do add perhaps unnecessary complication to the already convoluted process of developing and running an undergraduate design programme but these are issues that can be resolved by updating how programmes are developed and are not an inherent flaw in industrial collaborations.

The findings of the research also suggest that live projects do improve student engagement and performance, and that they benefit not only the students engaged in the project, but also the perception of the programme to prospective students, industry, alumni and the reputation of the university in a wider context.

From the research conducted for this paper, it is clear that live projects can enhance the students experience greatly. It is also clear that more often than not, implementation of live projects is picked up by proactive members of staff and used for innovation in areas within their core teaching responsibilities.

It seems clear that more work is needed to effectively integrate live projects into the core structure of programme development and ensure that they are well managed and structured from the outset so that both partners are clear about what is expected of them.

In a changing academic landscape, universities need to develop better systems to help integrate industrial partnerships into core teaching activity if they are to keep pace with the demands of design graduates and industry.

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