INTERNATIONAL DESIGN CONFERENCE - DESIGN 2012
Dubrovnik - Croatia, May 21 - 24, 2012.

JOINED-UP DESIGN: UNDERGRADUATE TECHNICAL SKILLS ACQUISITION

S. Porobic and F. Schaber

Keywords: live projects, young design programme, digital skills acquisition, urban regeneration

1. Introduction

This paper documents a study of cooperative and situated learning based on the Sorrell Foundation's Young Design Programme which aims to promote a collaboration between design students and secondary school pupils, by asking them "what they want to improve in their schools" [Sorrell 2008]. This programme informs the process of regeneration of school campus and surrounding community. The approach followed recent policy initiatives in the United Kingdom (UK) such as the 'Widening Participation' programme and the 'Creative Partnerships', a creative learning initiative designed to develop the skills of young people across England. They foster innovative, long-term partnerships between schools and creative professionals, including architects, scientists, multimedia developers and artists.

The paper discusses the engagement of the University of Northampton with the programme and analyses the feedback from the participating student mentor, a practicing architect, contrasting this with other feedback that the Sorrell Foundation collated during previous iterations of the programme. Research [Butcher 2008] has been published on student learning and acquisition of soft skills. However, qualitative feedback on this programme, from collaborating industry mentors and other stakeholders, has not been systematically captured, discussed or evaluated. The Sorrell Foundation gathers industry feedback through evaluation forms, much of this remains unpublished. In this paper, however, we hope to highlight the reflections of the participating mentor who is a chartered architect, in view of technical skills acquisition, CAD competencies, and the positive outcome that this kind of life client engagement facilitated. We anticipate that the feedback to have a practitioner's perspective, is grounded in the 'real world' and thus differ from tenured fulltime teaching staff and other stakeholders, such as education and planning authorities.

2. Community programmes and design intervention

It has been reported [Viljoen 2007] that live client projects in Design Studies enhance the curriculum; they not only challenge undergraduate students with outside constraints and deliverables but also further their technical knowledge. At the same time, research skills such as shadowing, exploration and representation are being developed. In return, the community benefits from university links on various levels. 'Service Learning' [Lerner 1998], which involves matching a community need with academic goals, is becoming increasingly important in Higher Education, with assignments set for students, where an actual commercial client or community partner requests input from students to solve a particular problem. For example, a comparative study of live practice in the UK [Viljoen 2007] reviews the extent of live projects and related research in Learning and Teaching, and also classifies the different types. Other studies, such as Butcher [Butcher 2008] presented work on the Sorrell

Foundation, also exemplified university students' community engagement, primarily working with schools. These studies demonstrated that involving design students in regeneration projects has the potential to impact on the communities in a real way, at the same time, furthering student learning. Their research focuses in particular on the enhancement of soft or interpersonal skills through live client engagement. This study, however, aims to shed light on the technical skills acquisition, and to present recommendations.

2.1 Background research

In the UK, driven by government policy, there is literature on engaging young people in industry and community, with emphasis on the creative industry, innovation and in the arts. Government policy documents, such as the reviews by George Cox, Sandy Leitch and James Dyson explore the practical challenges, with examples of university-led programmes of work-based activities for young people. Academic research on mentoring [Butcher 2011] emphasizes psycho-social functions including communication skills, supportiveness, enthusiasm and flexibility, alongside a willingness to commit time in a helping relationship; highlighting the tutoring of learners through email and online modes of interaction - video conferencing and the organisation of extra-curricular study as we will find exemplified in our case study.

Correspondingly, the academic literature on project-based learning through university engagement with business and community is evolving. Here, we refer to case study research on the 'Capstone' and business facing engineering programmes at Howard University [Thigpen 2004], Aalto University's problem based learning approach to train and manage multidisciplinary teams [Karjalainen 2011], and the Karlsruhe Education Model for Product Development, giving students hands-on experience with modern methods and technology [Albers 2009]. All these approaches foster active learning experiences, placing an emphasis on industry briefs, industry models of engagement with companies, incentives and employability enhancing networks. With the introduction of live client projects into the curriculum, the student's experience has been enhanced. Schmid-Kirsch [Schmid-Kirsch 2010] offers an insight into the acquisition of technical skills related to spatial design and analogue competencies, and deals with the role of traditional drawing and sketching in times of computer aided design. To sketch is and will be an essential skill in some professions. Artists, designers and architects and maybe some others still need to sketch and the students' involved in the case study learnt that this skill is key for client communication.

2.2 Objectives

The authors aim to describe the engagement with the Sorrell Foundation as a model for other suitable 'live client' projects that support problem based learning. They assess the resulting improvement in students' technical skills under the following headings:

- Research and investigative skills, in conducting surveys, and community consultation.
- Familiarization with the nature of a feasibility study, clarification of the nature of a master plan (full design proposal) or client project brief, which has been the foundation of this project.
- Use of references, undertaking site visits and conducting surveys.
- Design skills: concept generation, visual communication including sketching and CAD.
- Appreciation of design management skills and business deliverables.

2.3 Methods

This paper discusses a case study focused on a live client project collaborating with secondary schools as clients and with an industry mentor guiding the participating students. Information was collected utilizing both quantitative and qualitative means. This included (a) student oral and written feedback, (b) client engagement and oral feedback, and (c) summative student assessment through presentations and multi-angled feedback by staff and peers, recorded through a scribe and documented with audiovisual footage.

The findings were then analysed whilst incorporating the views gathered through the authors' participant observation method in the live project. One of the authors is a practicing architect, who mentored the students. His role was facilitated by an external financial support through the Sorrell Foundation, which enabled the university to timetable him on four separate occasions, spanning a critical part of the six months' long engagement. The second author, part of a staff team teaching Design undergraduates, acted as programme coordinator on behalf of the Sorrell Foundation. The authors reviewed the structure and design of the live projects in terms of pedagogical principles and their effectiveness was also assessed through the students' Personal Development Portfolio. The findings align with the Pilot Evaluation of the Young Design Programme 2005-2008 [Rudd 2008] concludes that the "*the client-centred model encouraging 'real life' experience of the cycle of a design project, has been extremely effective in bringing institutions and individuals together*".

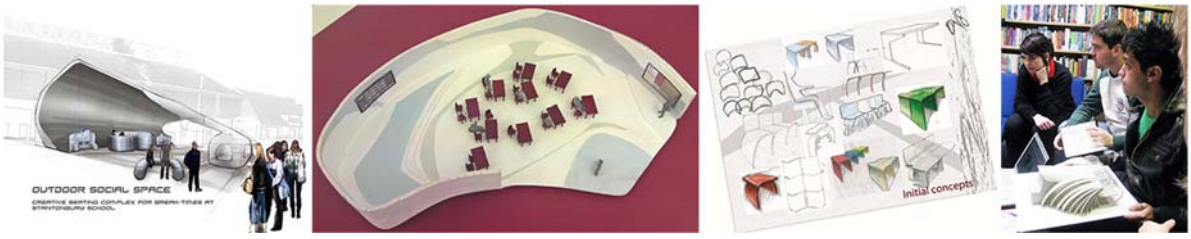

Figure 1. Students pursue analogue tools such as model making and sketching during design stages

2.4 Technical skill sets

A basic principle of the described programme is to provide students with the technical skills necessary for effective working within a professional context. The impact of new technologies, systems and professional concepts will introduce additional and disparate challenges, and this problem based learning approach seeks to provide some of the the skills and strategies needed to cope with such uncertainty and change. The programme allows to develop broadly-based analytical and evaluative skills and to provide ways in which practical applications can be undertaken, the results of which will lead to developing confidence on the part of students, in dealing with a diverse range of information, complex ideas, management concepts, problem-solving and practical skills. The knowledge and abilities needed to accomplish engineering, scientific or computer-related duties will complement the creative competencies of design students and affording employability for those with technical skills in a R&D environment as designers, technicians or technologists.

3. Project description

In the past many schools have been designed without the pupils' involvement, so, in the year 2000 the Sorrell Foundation set up a programme to give pupils a voice [Sorrell 2008]. The Joinedupdesign for Academies programme was mapped on an earlier iteration, the Young Design Programme, but is more rigorous as the pupil clients worked with student designers from universities, who were mentored by professional designers or architects. In 2009 a total of 100 pupils and 30 design students took part in the programme, creating a 'Pupils' Brief' for each of the 5 new Academies. The pupil client team for All Saints Academy in Dunstable and Bedford Academy in Bedford with their feeder schools worked with student designers from the University of Northampton. The Pupils' Brief for each academy summarised what the clients had asked for, and included design concepts from the university students. The publication of each brief marks the beginning of the next stage of the process in which, through continued engagement with the project, each client team can contribute to pragmatic decisions and the overall vision for their academy. Following a briefing session at the challenge day, the newly formed groups were going on an inspiring visit, creating the brief and concept presentations created by the student designers.

The teaching and learning methods used in the case study include: Teamwork and group project in investigation phase, seminar tutorials and client presentation, site visits, surveys and community consultation, continuous assessment including formative and summative reviews and multiple

feedback opportunities from client team. The University's Design staff, after having attended an explanatory talk at a launch event at the London headquarter of the Sorrell Foundation, developed a student assignment and mapped this onto the curriculum. Eight student teams were composed and these were deliberately cross-disciplinary in order to provide them with the experience of working with people from different subject specialisms; namely Product and Interior Design. During a set series of meetings, design teams showed their clients around the college and other exemplary buildings and the client teams presented their design problems; these included school communal and reception areas, outdoor spaces, toilets and specialist classrooms.

Figure 2. Student designers with their pupil clients, recording thoughts and ideas

4. Working with an industry mentor

Here, we discuss the reflections of the participating mentor and chartered architect in details in view of technical skills acquisition, CAD competencies, and the positive outcome resulted from this kind of life client engagement. Sid Porobic, an architect, considers his role as a moderator and facilitator in terms of design process, and, at the same time, as a guide who could provide answers to technical questions. He further states that "My practice uses glass as one of the predominant architectural materials in our designs; therefore I was in position to give direct answers in terms of buildability and technical adequacy. I was also directly involved in development of the architectural rendering plugin for the SketchUp software called Podium. That was one of the tools used in development of the design proposal."

The most important issues for the Bedford Academy pupil client team were dinner halls and social spaces, prompted by the inadequate shape of their existing dinner hall. As far as the pupils were concerned, the space had a poor visibility line and it did not have distinct identity in that it looked and felt like as one of the converted classrooms. The choice of the furniture was considered institutional and place was not inviting and "warm".

The pupils were unequivocal in their statements. They wanted for the new dinning and social space to have high visibility and to have landmark status in the new Academy. The pupils also wanted more generous space and, at the same time, they wanted it to be serene and highly enjoyable. For social space, the team requested a colourful and exciting multipurpose space with comfortable and playful furniture. Afterwards, pupils produced clients brief in shape of mood boards punctuated with key words (see Figure 2).

Responding to the client, one student group created concepts for a new dinner hall, social area and outdoor space that pupils could use during breaks, and before and after school hours. For the dining space on the ground floor, they wanted a light and open feel, and to solve the problem of limited visibility that pupils had highlighted. They prepared concepts exploring transparency and openness using full height structural frameless glass system enclosed by stretched tensile secondary skin roof. The idea was to create shading and to moderate heat excess by using passive control, and yet still maintaining openness and transparency.

This choice triggered a series of investigations to arrive at an appropriate solution in terms of specification for glass and tensile structure. The glass units that they settled with were double glazed units: external pane was a toughened active, self-cleaning glass with factory applied tinting whereas internal pane was laminated glass with heat reflective coating. The cavity was proposed to be filled with gas to decrease the U value. The glass panels were held in position via so called frameless fixing where joints were visible only from outside.

In considering specification students were guided by the principle of both structural and environmental performance coupled with understanding of cost implication. For the tensile structure, students settled

on PTFE (Teflon) coated fibreglass skin with stainless steel cables. The interior students proposed hardwearing, easy-to-clean materials, such as rubber and timber laminates for flooring and furniture, in order to give the space a modern, uncluttered feel. The students paid particular attention to furniture by designing elements such as a hanging table that would appear different from classrooms. It was critical to emphasize the distinction between various spaces. They wanted to offset the industrial ambience of the ground floor by placing more comfortable furniture for the first-floor social space.
Accessibility was an important concern for the mentor; hence, attention was paid to all spaces having ease of access. The students explained how a lift could provide an injection of colour and light into the space, perhaps changing as it moved up or down. They also presented pupils ideas for a queuing system, where they could see what was on offer prior to making a choice. After talking to younger pupils, the students also proposed an addition to the design: a smaller, separate space where the first year students at the Academy could see older pupils whilst being assured of the sense of safety.

4.1 Digital and analogue design process

The initial response to the clients' brief was a series of sketching sessions, an analogue process described by [Schmid-Kirsch 2010]. The design team was defining and distilling meaning and direction given by the clients. For the mentor it was interesting to observe how both product and interior design students responded to a given brief in a similar, and yet a different, unique way. Product designers were immediately interested in usability and tactile definitions through shapes and materials. He could clearly see that their interest was directed towards furniture and objects usability and proposed a suitable CAD application. In contrast, interior students responded more on an abstract level by exploring user's spatial interaction instead; they were more interested in space usability and psychology. Particular interest was directed towards exploring how different functions relate to each other. They were also interested in how spaces flow and how to achieve clean site lines, visualising with PhotoShop™. During this period the mentor introduced Podium™ as rendering plugin for the SketchUp™ CAD software. Due to the ease of use and interactivity, SketchUp™ was employed as a main 3D computer-modelling tool. Regardless, students were actively encouraged to experiment with other 3D software products, such as Blender™ and Rhino 3D™ in both form finding exercises as well as in the production of the final design.

Figure 3. Early stage SketchUp™ work and Podium™ enhanced renders illustrating various stages of digital skills acquisition

4.2 Modes of interaction with the mentor

The interaction between the mentor and the students took place by means of an individual/small group verbal discussion, on-line communication, or, using computer softwares related to a specific aspect of design matters. The role of the mentor was "to direct them to recognise each other's strengths and use them for the benefit of the team".
All in all, the mentors had four sessions with the design team, each lasting about two hours at a time. The sessions were arranged around particular themes such as use of technology, use of materials, rendering and presentation. On-line support was also provided to facilitate email communication between the mentor and the team. These were mostly related to the use of particular materials and their appropriateness in the particular application/context.
Throughout the design process students concurrently used analogue and digital tools such as physical models, free hand sketches, computer digital models and animation in pursuit of exploring different design solutions. There was a lot of experimentation such as creating hybrid outputs where both digital

and analogue techniques were mixed. For example, hand drawn sketches and photos of the working models were digitised and further manipulated in digital space.

4.3 Online conferencing and planning consultation

When an authority in architectural rendering circles was brought in and delivered a rendering session, Skype™ enabled the communication possible between the students and Jacques Cleghorn, who was based in Cape Town, South Africa. The mentor found it fruitful as he delivered, throughout this online session, energising and inspirational session in rendering dielectric materials such as glass and acrylic.
It was also very interesting to observe how young pupils showed a high level of maturity in all discussion with the design team. On the other hand, the students showed high level of professionalism in responding to their client needs. Their ability to be positively engaged in the client team's ever evolving and, sometimes, contradictory instructions were highly commendable. Furthermore, experience that students gained through the real client project was invaluable. Due to the fact that the project was ment to inform a planning process rather to be executed in full, students did not go through mandatory consultation with the local authority. To make the process as real as possible, however, the mentor took the roles of planning officer and building regulation officer, directing students to comply with various legislations in a manner, which would be similar if the project was being prepared for planning approval and building regulation approval.

5. Benefits for students, staff and institution

The relationship between community, local schools and academic institutions is enhancing the curriculum, developing skills sets and providing networking opportunities to benefit the parties involved. It has led to changes in design teaching, by reinforcing communication and design management skills. The exposure to long-term working relationships will also affect the student experience. To the undergraduates participating in the project, what was in the heart of their experience were that of curriculum enrichment through live client projects, exposure to business situations, project management and a real understanding of social issues in the local community.
In terms of design studies, the production of models and prototypes enhances manual skills and a deepened understanding of 3D CAD. Furthermore, a visual language, in the form of drawings and models is key. The case study indeed confirm the importance of teaching visual communication. Along with visual communication skills, it is also found that oral presentation skills have to be refined when presenting their work to live clients, often at community and board level, as it often bears a direct implication on one's employability.

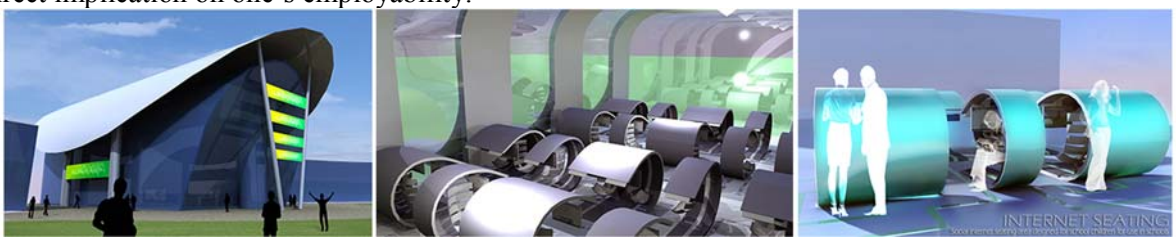

Figure 4. Digital skills demonstrating the use of render plug-ins during the final stages of the design process

5.1 Self-reported evidence

As reported in previous research on its sister programme, the Sorrell Young Design Programme [Butcher 2008], undergraduate student learning from joinedupdesign for Academies was both wide and deep, although less about developing the students' own Design skills than broader interpersonal skills. Some self-reported evidence across the group did include the acquisition of design skills in: "... using a laser cutter... in model-making... in photographing work for presentations, improving my computer skills in Photoshop... I am more confident knowing I've got that skill... designing for different types of clients and thinking about the needs of disabled pupils... working with other design disciplines... learning how Product Designers draw products... sketching in CAD".

However, this acquisition of new technical design skills was viewed by undergraduates as a by-product of their involvement in the programme, rather than a core learning experience. The greatest evidence of perceived enhancement of their learning came in the 'softer', inter-disciplinary skills related to employability. In this, the bulk of feedback was around: team work; problem-solving and time management; working with clients, and in relation to future employment. The applied research undertaken by academic staff in the context of this and a related case study [Butcher 2008, 2011] provides up-to-date understanding of multi-layered communication and managerial skills and the awareness to planning issues, publicity strategies and manufacturing processes, which can be fed back into teaching. This corresponds with the findings of Albers [2009] who had shown how educational project work at an integrated product development course, exemplified by teamwork and cooperation, enables key competenies of students. At his institution this "has led to a multilayer organizational system for procuring competence in product development."

5.2 Feedback through questionnaire by Sorrell Foundation

The impact of both the Joinedupdesign for Academies and Young Design Programme on student learning was captured by Sorrell's facilitators who asked to discuss: new skills, developed skills, balancing the programme with other college learning activities, working with pupils and working with mentors.

Semi-structured questionnaire and interviews asked about impact on the professional skills and perception of professional practice and possible career routes, the results have been discussed by [Butcher 2011]. Generally students were pleased to have had the opportunity to take their current skills and develop them in a practical and realistic setting rather than being given theoretical tasks to work on. "Most students felt that their 'soft' skills had been improved by participating and their professional mentors and tutors also noted this. Indeed, all mentors who completed questionnaires noted in their responses that they felt that the students had developed skills in the areas of problem-solving, presentation, team-working, negotiation, organisation and communication, as well as new design skills and new knowledge about the design industry." [Rudd 2008]

6. Summary of design student learning

The paper presents a case study within the Sorrell Foundation's Young Design and Joinedupdesign for Academies programmes, aiming to promote the collaboration between design students and secondary school pupils. The paper reports on technical skills gained through engagement with the programme, and the authors reflect on the process, since they took part as mentors and tutors.

The live project supported cooperative and situated learning and recognized multiple competencies and different learning styles. As noted above, the process of negotiation and planning of a live project tended to engage verbal, linguistic and interpersonal intelligence, as well as visual and spatial intelligence. For this reason, it is feasible that such teaching and learning methods could be adapted for other subject areas if the concept of live projects were to be utilised. For example, client presentation, site visits, surveys and community consultation; also, multiple feedback opportunities from client team, staff and industry mentor.

To recap the six months long process, the client team extensively briefed the students. Throughout group work and plenary sessions, problems were identified continuously leading up to the last stage of finalising a design brief. The Sorrell Foundation's programme enabled students from differing design subject backgrounds to work together and to share a range of learning outcomes.

Work was monitored by means of individual and group tutorials and additional practical demonstrations of technical and visual skills enhanced the project, due to the funding granted by the foundation. The student design teams presented the newly designed environments back to the pupil clients. This offered the school children the opportunity to gain an insight into the design industry and university design study process. Having acquired much from the experience, the children regarded highly of the students as professionals. One of the children stated that "It was fun working with real architects; they could transfer our visions for the new academy in to proper designs that looked amazing." A positive response such as this, in turn, bolstered students' confidence in their newly

acquired technical skill sets and facilitated them prepare themselves in working environments with different client groups.

References

Albers, A., Sauter, C., Maier, T. and Geier, M., "KALEP, an engineering education model supported by modern IT solutions", Proceedings of the International Conference on Engineering Education and Research, Seoul, 2009.

Butcher, J. and Schaber, F., "Enhancing Design Learning through Complexity: the case of Joinedupdesign for Academies", Networks. Vol.13. The Higher Education Academy, London, UK, 2011.

Butcher, J., "Off-campus Learning and Employability in Undergraduate Design: the Sorrell Young Design Project as an Innovative Partnership", Art, Design & Communication in Higher Education, Vol.7, No.2., 2008, pp.171-184.

Karjalainen, T., Heiniö, S., Graff, D., Koria, M. and Salimäki, M.,"Speaking design: Development of multidisciplinary language and project management skills in design, business and engineering education", Proceedings of the 13th International Conference on Engineering and Product Design Education, Design Society, Glasgow, 2011.

Lerner R. M. and Simon L. A., "University-Community Collaborations for the Twenty-First Century: Outreach Scholarship for Youth and Families", Garland, New York, 1998.

Rudd, P., Marshall, H. and Marson-Smith, H., "Pilot Evaluation of the Young Design Programme 2005-2008", National Foundation for Educational Research Publications, Slough, 2008.

Schmid-Kirsch, A., "Starting with a Cube. The Cube as the Perfect Guide to Sketch Descriptive Geometry in Art, Design and Architecture", Journal for Geometry and Graphics, Vol.14, 2010.

The Sorrell Foundation, "The Pupils' Brief", The Sorrell Foundation, London, 2008.

Thigpen, L, Glakpe E, Gomes G, Mccloud T. "A Model for Teaching Multidisciplinary Capstone Design In Mechanical Engineering", Proceedings of the 34th ASEE/IEEE Frontiers in Education Conference, Savannah, 2004.

Viljoen, A. and Hoskyns T., "For Real: A Review of the Extent of 'Live Practice' within 3D Design Education in the UK and its Potential Contribution to Curriculum Development within the ADM Subject Area", University of Brighton, 2007.

Mr Sid Porobic
Associate Lecturer
The University of Northampton, Design
School of the Arts, St. Georges Avenue, Northampton NN2 6JD, UK
Telephone: 0044 1604 735 500
Email: sid.porobic@northampton.ac.uk
URL: https://www.northampton.ac.uk