Educating Students for the Collaborative Workplace

Educating Students for the Collaborative Workplace: Facilitating Interdisciplinary Learning in Construction Courses

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This paper addresses the provision of interdisciplinary learning opportunities for students enrolled on Built Environment, Design and Construction courses in Higher Education Institutions (HEIs), drawing from a variety of case studies based in the UK. The paper cites published literature from across disciplinary boundaries, demonstrating a need for, and an interest in, interprofessional collaborative learning. Case studies of seven projects from four UK HEIs are reviewed and strategies compared. The studies demonstrate the value of such teaching; the context within which the teaching is provided; some examples of good practice; of disincentives and of barriers; and student feedback. Key shared characteristics begin to suggest a taxonomy of collaborative projects. The paper concludes with suggested actions and/or strategies that could be employed by Schools, HEIs and/or Institutions to further incentivise such teaching.

Key Words: Collaborative learning; interprofessional learning; multidisciplinary; built environment; design

Introduction

Educational programmes at undergraduate level may be accredited as 'routes to chartership' for architects, engineers, spatial planners, contractors and surveyors. Such programmes are curated to meet criteria from those professional institutions, all of which require courses to deliver skills in (for example) teamworking, collaborative decision-making, communication, and knowledge of co-professionals. Examples from UK professional institutional criteria include explicit mentions of *collaboration* (criteria A2, C1, D3, Engineering Council, 2014), *users and co-professionals* (criteria GC 5.1, 6.1, 7.3, 11.2, RIBA, 2011), *respect for team members* (criteria 2.2, 2.3, 2.6, CIOB, 2013), and *Managing People… Communication and Negotiation* (APS Competencies, RICS, 2014), seek to ensure that putative professionals emerge from education ready to perform at a high level, as part of multidisciplinary teams in complex scenarios.

Many HEIs meet these required criteria through small- and large-group tasks and projects within the students' disciplinary cohort. Some expand this to include longitudinal collaboration across yeargroups. The premise of this paper, illustrated by Figure 1, is that wider cross- and trans-disciplinary collaborative working is an essential part of professional education in developing skills for industry practice, as part of both accredited programmes and related industry training. It is not sufficient to teach 'teamworking' in intra-disciplinary groups. Effective learning can only take place in larger, multidisciplinary team scenarios.

Figure 1: Sphere of experience in Education vs sphere of influence in industry practice. [Graphic demonstrates proportional relationships of statistical team member input]

(MacLaren and Birchall, 2016)

The current student, emerging into a global industry, must exercise 'the ability to take the initiative and make appropriate decisions in complex and unpredictable circumstances', a requirement of architectural (design) education (RIBA, 2011). While there is ongoing debate about the value of, or devalue in higher education, 'The design industry still values degree-level study: …. 76% of employers expect to employ only graduates in design roles. [but]… 58% of those employers also said that they are dissatisfied with what those graduates bring to the workplace, citing communication, commercial awareness and basic business skills as lacking' (Design Council, 2016). We will argue that these skills can be effectively developed and delivered through *collaborative multidisciplinary design projects.* Cultivating good communication through exposure to interdisciplinary collaboration demonstrates to students the critical role that relationship building plays in establishing, and sustaining a practice.

This paper uses the terms 'interprofessional', 'interdisciplinary', and 'multidisciplinary' interchangeably in this discussion of collaborative professional education. Whilst the semantic differentiation of these words may be helpful in a specific context, in this overview paper the terms overlap more than they might helpfully discriminate.

Industry Context

Emerging in the nineteenth century, qualities of 'professionalism' have been the subject of much educational theory (Schön 1983, Eraut 1994, Guile, 2010, Young & Muller 2014). A relatively simple definition might be "*trust* and *the exercise of judgment* based on specialist knowledge." (Duffy & Rabeneck, 2013). Professional Institutions seek to engender educational programmes that teach these qualities, and base their accreditation criteria on extant professional roles and activities.

This presumption of stasis in future professional transactions is not logical in a rapidly expanding sharing economy. Standing's study (2011) results in the neologistic roles 'profician' and 'precariat', reflecting the extant and growing diversity in contracted employment. The increasingly global, collaborative, complex construction industry in contemporary society requires instead, "new skills and competences…. being able to learn, develop and adapt rapidly". (Susskind & Susskind, 2015). Navigating this context requires individuals to have a good holistic knowledge of their industry, a tacit understanding of the roles of others, an ability to apply theoretical knowledge to complex scenarios, a sense of their place within the wider team, and most importantly, an ability to communicate across disciplines and cultures on an international scale. Increasing use of technology requires improved communications skills, and countless examples from contemporary construction industry reports demonstrate the growing requirement for interdisciplinary collaboration across the built environment (UK Gov't Construction Strategy 2011, International BuildingSMART Statement of Intention 2011, BAF BIM/education report 2013, 'Collaboration for Change', Morrell 2015).

Higher Education Context in the UK

HEI funding incentives and Industry aspirations for future professional practice are not aligned. In pursuit of funding and league-table recognition, HEIs seek to appoint PhD-qualified, specialist candidates, with specialist research profiles, to permanent academic posts. Meanwhile, government and Industry policy pushes in the direction of collaborative practice, supported to some extent by institutional accreditation criteria requiring generalist abilities and holistic industry awareness.

This demonstrates a disparity between the emerging 'career academic' (Tennant et al, 2015), tending by nature to be specialist and discipline-specific, and the increasing demands for inter- and cross- professional training from the workplace. The trend toward 'specialist' HEI

educators leads to built environment programmes being led by narrow-focus specialists, themselves without broad industry experience. Academic course leaders in this scenario may not realise the potential benefits of cross-disciplinary collaborative education: and in any case, may not possess the wider skillset or connections to enable the introduction of such programmes.

There is a growing dichotomy between the aims of accredited professional education and the nature of the Higher Education environment, particularly in the UK.

Building a picture of current practice: Case Study Methodology

A review of professional literature indicates the fallacy of adopting insular professional theory to articulate interprofessional activity. Cross-disciplinary exchange and educational formats are ontologically different from mono-disciplinary engagement confined within a single specialism. The interdisciplinary field therefore requires a different lens to study and articulate the characteristics of multidisciplinary educational activities. In accordance with the naturally heterogeneous approach of collaborative education, the study adopts a mixed-methods analysis.

Whilst there is limited literature studying interprofessional education in Construction, the field is a popular area for study amongst other sectors: particularly in Healthcare. 'Inter-Professional Education' (IPE) has specific, established representative bodies engaged in research and best practice in both the UK (CAIPE) and NCIPE and IPEC in the US. The authors also reviewed studies from occupational safety (Kapp, 2009) and international collaborations (for example, Long & Carlo, 2013). This relative wealth of academic enquiry into collaborative learning provides a basis for analysing the trends and characteristics noted above, in relation to understanding how best to enable these learning experiences universally when applied to professional built environment education. It is noted that studies in IPE began by collating a breadth of evidence and identifying commonalities and differentials, in this process beginning to define a vocabulary for further study. This paper follows a similar methodology, in presenting a series of extant projects as both qualitative narrative description and in a tabulated quantitative format, and then reflecting on shared and diverse characteristics.

The reflection is informed by a reading of contemporary studies, noted above, and a summative paper from Wood and Gray (1991) which itself draw from eleven articles in the *Journal of Applied Behavioral Science*, seeking to define commonalities between interdisciplinary collaborative projects, and to arrive at a universal definition of collaboration. Their definition (endorsed by the AIA through signposting from their accreditation pages);

> "*collaboration occurs when a group of autonomous stakeholders of a problem domain engage in an interactive process, using shared rules, norms and structures, to act or decide on issues related to that domain*" (Wood and Gray, 1991)

This paper adopts that statement as a critical lens through which to describe and measure each case study, signposted in the presentation of the first case study below, and thereafter implied. This in turn provides a constructed framework for later discussion of the common characteristics of each study, and enables a more detailed investigation into shared themes, experiences, and the structures necessary to enable these projects. Reference is made to several studies, published internationally and relating to multiple industries, where reflections arising from this paper correlate to observations previously made elsewhere.

Excellent examples of interdisciplinary collaborative learning exist in built environment education (in the US, Selman & Westcott, 2005; Neuman, 2016; and in the UK Harris & Widder, 2014; and at www.liveprojectsnetwork.org); but there is a paucity of literature developing a taxonomy of praxis or sharing and developing that best practice. The reflections following the case studies presented below seek to develop the discourse, evidenced above, into how best collaborative projects can be effectively a/ *delivered,* and b/ *enabled.* It is hoped that this initial scoping analysis may form the basis of developing further research in the area of collaborative construction education, internationally.

Case Studies

At a seminar in Summer 2015, academics from seven institutions met to share their experience of collaborative cross-disciplinary projects on built environment courses. The subsequent examples are surmised below, and compared in Table 1.

Table 1: Table comparing Case Study Projects from workshop participants

Case Study 1:
Leeds Beckett University; Final Year Undergraduate Students

Background
The School of the Built Environment and Engineering delivers a collaborative learning project to its final year undergraduate students which covers the disciplines of: Quantity Surveying, Building Surveying, Architectural Technology and Project Management. It is designed to enable both full time and sandwich students of all disciplines [*autonomous stakeholders]* to work together, combining their particular disciplinary skills to arrive at an overall development project proposal [a shared *problem domain*].

The learning outcomes are both discipline-based for each specific area, and generally team-based in relation to how groups and teams form and work together [partially *shared rules*]. The team working learning experience is also enhanced by a reflective essay summarising how the team developed throughout the 12-week period of its existence.

Figure 2 : Case Study 1, *Interprofessional Studies,* Leeds Beckett University

Project Format
The project is a ‘development pitch’ based on a site where the students are placed in teams and are asked to provide conceptual designs and costings as a pitch to developers. They should also provide reports particular to each discipline which align with the overall development proposal.

Initially the project was based on an imaginary site to the west of Leeds but feedback from the students highlighted that they were looking for more information on the site relating to logistics and the surrounding area that could not be provided for the imaginary site. This feedback was considered and a local large development site, the old Tetley Brewery, was researched and used for following cohorts.

Observations were recorded by lecturers during the delivery of the module, with particular attention to team working and dynamics. It was noted that the imposition of team membership led to an early struggle in each team, to develop an effective means of cooperation. There had been a conscious decision to force the teams to work with other

students than their habitual peers, so the tutor team instituted a strategy for enhancing team work. This led to the presentation of Belbin's *self-perception inventory* (Belbin, 1993) encouraging team members to interrogate and reflect on their roles and traits, [*shared norms and* structures] with the aim of improving their ability to work together.

A further development in the team working has been to require the teams, after completion and review of the self-perception inventory, to further develop their knowledge in this area by selecting and offering a subsequent presentation on an alternative teamworking theory. These exercises sit alongside the formal outputs.

Summary
At each junction of change the students' feedback has been reviewed along with their engagement with the project to ensure they report an engaging and satisfying learning experience. Feedback has seen a positive increase after each change has been applied. Tutor observations of the students and their intra-group performance has also shown they form a stronger relationship much more quickly than previously observed.

The change from an imaginary site to a real one, with detailed information freely available has produced better-informed proposals that are more in line with Local Authority Planning requirements. The student groups have also demonstrated increased engagement and initiative, for example providing material from other sources for use in following years to enhance future students' understanding of the site. The ability to visit the site has enable students to identify conflict areas and highlight 'wicked' problems that might otherwise not have been considered which has further enhanced the learning of the students.

Case Study 2:
Heriot Watt University; Final Year Undergraduate Students

Background
For over 10 years, Heriot-Watt University has included, in the final year of its undergraduate programmes in Civil/Structural/Architectural Engineering, Construction Project Management, Real Estate, Quantity Surveying, Urban Planning and Property Development, an immersive 'collaborative week' exercise. The aim of this is to expose students across built environment disciplines within the University to multi-disciplinary project working in a real-life context.

Figure 3 : Case Study 2, *Collaborative Project*, Heriot-Watt University

Project Format
In week 1 of semester 1 of their final undergraduate year, built environment students are allocated into multi-disciplinary groups of around 1-15 students. These groups work for 4 days to prepare a development proposal for a real site which they present to staff, students and invited industry guests on day 5. The collaborative output at the end of this short, intense period is not formally assessed, although for the remainder of the semester the students use their experience on the week, and their co-authored proposal, to inform an assessed 'Design Project' course.

Summary
Students are fully and solely engaged with the exercise for the week (all other classes are cancelled). Feedback over several years confirms that they find the experience socially and mentally challenging but informative, and this feeds into later 'reflective writing' exercises and provides the context for self-authored unidisciplinary design projects. The students develop skills in group dynamics and in group presentation, and also a broader understanding

and awareness of the activities of related disciplines. This exercise is regularly rated as the most memorable of their student experience.

Case Study 3:
Edinburgh College of Art, University of Edinburgh; First Year Undergraduate Students

Background
In the academic year 2012/2013, The University of Edinburgh, Edinburgh College of Art included in their first year curriculum a collaborative project for first year students known as *Risk*. The aim of this was to expose design students to working with academic colleagues from nine disciplines on a single, shared project. The focus was to define what they felt were risks in their lives and in contemporary life, and explore together, ways of expressing and addressing those issues. All staff in the Design School were asked to pitch ideas for these projects, with a budget of £1000 available to run the successful pitch.

Figure 4 : Case Study 3, *Breaking Barriers: Risk*; University of Edinburgh

Project Format
The successful pitch was called Breaking Barriers. Its format looked at the concept of barriers and exclusion, with a focus on walls such as the Flodden Wall, which surrounded the neighbouring Edinburgh Castle in the 16th century, and Mark Wallinger's State Britain project. The HEI lead also involved a professional environmental artist. This external source gave the students first-hand experience of the practice of an industry professional, whilst working within that discipline themselves. During the initial intensive week students started working in mixed groups of 3-4 students; towards the end of the week they were invited to work individually.

Students undertook a series of research and design development tasks that resulted in a combined visual output. They were subsequently challenged to express their own experiences and emerging reflections on 'risk' and 'barrier' through building three dimensional scenes in a set of uniform cardboard boxes (120 in total). This defined a common output in terms of size, but they were free to explore the inhabitation of their individual box. On the final day they worked together to assemble these vitrines into a barrier across the central exhibition space of the school. This was then destroyed by the students as the climax of the final exhibition event. For the remainder of the semester each student produced, within their own department, a portfolio, blog or physical item that was inspired by the work they undertook in the initial week.

Summary
In the context of working across multiple student disciplines, this project found a positive structural basis in a mix of the unfamiliar (in the case of this project 'How do you define risk?), along with the familiar (a project structure that involves the sequential stages of research, design development and presentation of final ideas). Through combining mixed-disciplinary groups and subsequent individual work, the students were able to express their own ideas, but also to learn by example from the different approaches taken by other disciplines. For example, the illustration students tended to draw everything in great detail before approaching the making of a vitrine, whereas the product design students moved quickly onto iterative construction.

Student motivation was maintained by foregrounding a set, transparent structure for the course; every day there were clearly defined goals and a clear progression of work towards a final outcome. This allowed the project to gain momentum as it progressed, and sought, effectively, to prevent any hiatus due to unfamiliarity or indecision.

This short project demonstrated a lasting impact. Three years on, tutors have witnessed the growth of some of these professional relationships throughout the courses. The participating academic cohort, now in their final year, are observed by tutors to be more evidentially more proactive and confident than other cohorts in asking for advice from other disciplines in relation to their projects.

Case Study 4:
Heriot Watt University; Third Year Undergraduate Students

Background
The Illusion of Memory is a Scottish Quality Assurance Agency (QAA) & Heriot-Watt University (HWU) funded project under the QAA Enhancement Theme of "Student Transitions". The project was designed to enhance student transitions for Level 10 SCQF direct entry (DE) students entering into the 3rd year of study at HWU, through interdisciplinary engagement between interior design and textiles students. The project also sought to identify potential interdisciplinary research possibilities to staff in both schools. The collaborative project shared a common theme of *ageing in place*, designing 'older-age-friendly' environments, specifically, designing for individuals living with dementia.

Figure 5 : Case Study 4, *The Illusion of Memory*, Heriot-Watt University

Project Format
The Illusion of Memory has had 2 phases thus far, each engaging diverse input from outwith HWU: contributions from manufacturers, designers, clients and policymakers. The first phase culminated in an MSP sponsored event consisting of an exhibition and presentation of student work at the Scottish Parliament in May 2015, improving HEI engagement and raising the awareness of a wider global health and built environment themes. The second phase made more provision for students and staff to collaborate and co-design between disciplines alongside the dementia user groups, and included internal PhD candidates. Student group collaboration was enabled by small group discussions, encouraging the ultimate interdisciplinary project teams to form 'naturally', thus improving the final outcome of their collaborative work throughout semester two, but also assisting with DE student transitions during the vital transitional period of semester 1.

Summary
The achievements of this collaborative project have had a powerful impact on both staff and students, resulting in richer ideas, wider knowledge of interdisciplinary working and understanding of discipline specifics, and increased working with external industry partnerships. The project has enabled some integration of research upon the curriculum, the development of transferable skills in student participants, and the enhancement of transitional processes from FE through to HE and into the workplace.

On reflection, this has been a pioneering project for HWU, deriving from an informal chat at a course board meeting between new colleagues, and resulting in what is now becoming an established programme within the curriculum. This interdisciplinary approach to teaching and learning will ultimately challenge the way we shape the future curricula offering further opportunities for similar projects to evolve.

Case Study 5:
Heriot Watt University and FE Colleges; HNC/HND and All Undergraduate Students

Background
This project, as the previous example, sought to ease Student Transitions, in particular at two stages: from College to University, and from University to Employment. The project founded "Designing Live" (DL), an ongoing pedagogic vehicle for collaborative design events. DL is a series of stand-alone one-day design events, located outside of the university campus and engaging with industry.

Figure 6 : Case Study 5, *Designing Live*, Heriot-Watt University

Project Format
A one-off speculative award for 'innovations in teaching' funded a series of one-day design 'Charrette' events were staged during Semester 2 of the 2014-15 academic year. These followed a simple pattern: The events were free to sign up for, catered and managed by HWU staff; participating students are divided into mixed groups on arrival; the main activity was an intensive day of active design-based teamwork all on one site, finishing with a celebration in the evening alongside invited guests. The project tested the hypothesis that an effective 'interactive process' with 'autonomous stakeholders' (Wood and Gray, ibid) could be achieved in a 24-hour standalone event, if sufficient structure and facilitation were provided.

An example: the first event, "DL: Home" was attended by 18 students, 50% of whom were current HWU students. The challenge was to design, in teams, a student bedroom for an individual. The creation of this 'client' was a short 'ice-breaking' exercise on arrival, conducted by the newly-matched teams: characteristics developed by playing a light-hearted game of 'consequences': key to the quick definition of the task and catalysing team bonding through a shared activity. The evening industry event was promoted via email and twitter, achieving great social media traction on the day, when photographs of the event 'tweeted' were picked up by major local media sources such as Creative Edinburgh. Representatives from 8 local industry employers attended the evening event, speaking directly with the students and 'judging' their work for a small prize. Subsequent events followed a similar pattern, with a changing emphasis on real site; real client, or live build project.

Summary
The events sought to develop skillsets that particularly assist at transitional stages; individual confidence and teamworking skills were developed through exercises themed in key areas of concept development, live build, and client presentation. These directly address known weaknesses in articulating FE college students, and bolster self-assurance in graduating HE students. The longitudinal student groups encourage peer learning. The themes were developed from conversation with teaching staff and external examiner feedback.

The requirement to work as cross-disciplinary teams at different stages also reinforces confidence, communication and collaboration skills, presentation abilities: all essential qualities for graduating HWU students and in line with university-wide Graduate Attributes.

Finally, the DL events also act as showcases for HWU in terms of outreach (when working with community) and industry engagement (invited professionals to evening gallery events). These experiences are key to Student Transition into the workplace, but also act as a promotional tool for the university in the community.

Case Study 6:
London South Bank University with 'Teambuild'; Undergraduate and Postgraduate Students

Background

Teambuild is an innovative, competition-based training format offered to students and young graduates in the construction industry. The competition is run by a registered Charity, 'Teambuild Association', comprising a board of five volunteer Trustees and two part-time administrative and executive staff, supported by a rotating group of recent alumni. 'Teambuild: The Construction Challenge' has been offered to students of London South Bank annually since 2014, open to all students in the built environment school, from first year to PhD level, enrolled in full- and part-time studies.

The format allows 'real-world' commercial experience to be gained in a controlled environment, including interaction with varied practising industry professionals in a manner that allows trial and error, informal conversations and regular structured feedback. The two-day format has been developed and honed over a 20-year period; is highly efficient, and offers enough value to the industry representatives that they donate their time, making the event extremely affordable and attractive to universities, colleges, and commercial companies.

Figure 7 : Case Study 6, *Teambuild*, London South Bank University

Project Format
The Teambuild administration match student applicants into teams, mixing age, experience, but primarily disciplinary specialism. The maximum number of people in a team in six. Over two days, the teams are fed a series of five briefs to answer in short (2-hour) periods, after which they must present their results to a team of 'judges'. The briefs are scenario-based, situated on a real working site local to the host university, and which participants have been given the opportunity to visit as a pre-sessional task.

The event is a competition; this is an intentional strategy to incentivise participants, and give members a shared goal for teamwork. Teams are assessed on their teamworking, communication and presentation skills, but explicitly NOT on their technical prowess (despite being based around highly technical tasks). Formal, verbal feedback is given by judges to each team after each presentation, allowing them to respond to this and to develop their skills ready for the next presentation. The frequency of brief issue and presentation slot requires teams increasingly to delegate and work on tasks simultaneously. The first group task ('name your team'), issued before the event, is intended to allow strangers to form relationships quickly, without individual disciplinary pressure. Over 48 hours the complexity of group management increases exponentially, and the intense nature of the experience leads to memorable, effective learning of collaborative and communication skills. Students also report an increased sense of disciplinary identity, realising the particular value of their specialist knowledge to a professional team.

Summary
The Teambuild experience seeks to plug a well-documented gap in construction industry training: the chasm between academic HE or FE training and the experience on the job. To date this training competition has been offered at three HEIs around the UK. Participants in Teambuild gain industry knowledge, valuable workplace skills, and self-confidence. They vastly increase their own self-confidence, and personal value and effectiveness to their (future) employers; and the skills developed are in line with HEIs' 'Graduate Attributes', an increasingly popular measure of general professional qualities. This statement is backed by consistent evidence from participant feedback, comments from participants' university tutors and workplace line managers, and responses from alumni of the competition.

Case Study 7:
Duncan of Jordanstone College of Art and Design (DJCAD), University of Dundee;

Second and Third year Undergraduate Students

Background
Since 2009, undergraduate students at DJCAD have been regularly engaging in the types of collaborative exchanges familiar to built environmental practitioners, as participants in the 'Group for International Design Education' (GIDE). Officially formed in 2003, GIDE has a far longer history and celebrated its 10th anniversary at the Ljubljana event in 2013.

GIDE is a dynamic international network, of eight nations including Scotland, China, Germany, Switzerland, Belgium, Italy, England and Slovenia. Cyclical collaborative projects that occur February to February, catalysed by shared visits and events, provide students with unusual intercultural design experiences. Here new working practices are established and different creative competences are forged.

GIDE collaborates annually with up to 200 participants from 8 nations and 4 disciplines in an international event. The GIDE strategy is to deliberately transform the nominal 'study-trip', bringing students and academics into direct contact with other international peers, local enterprise and regional practitioners. GIDE combines this with a symposium, a collaborative workshop, an exhibition and closing event. Creative outcomes from this international workshop week collectively help define a subsequent shared project delivered formally in the curricula across all eight partner schools in the following academic semester.

Figure 8 : Case Study 7, *GIDE*, University of Dundee

Project Format
Individuals are allocated a place in one of twelve international teams ensuring an interdisciplinary mix that maximizes the new learning opportunities in terms of exposure to peers' different design methods, competences and energy. Students who would typically be operating as independent [and isolated] creative practitioners in their home institutions, are confronted with new team experiences that will seem familiar to those in industry. Students are required to exercise their interpersonal skills.

The workshop is hosted by a participating HEI. Teams are supported by at least two guest tutors who take on new roles as 'producers' tasked with empowering teams, facilitating back of stage rather than acting out a role as 'director'. Students are 'the actors' and both producer and actor are primarily concerned with meeting the needs of the 'audience/client'. Tutor/ Producers also help individuals negotiate meaningful roles within their teams, which gradually take on the attributes of a design agency.

Teams are required to design a response to problems set, and judged [also often sponsored] by the regional enterprises familiar to whichever GIDE school is hosting the international workshop week. Design outcomes rely on improvised low-fidelity approaches and 'quick and dirty' methods, again common to emerging participatory practice in industry. This leads to higher-fidelity creative outcomes that can lie outwith any student's original disciplinary domain.

Summary
In addition to providing students with exciting opportunities to enhance their career potential and develop relationships with international design peers (who might indeed become future business partners), the GIDE experience provides a successful platform for regional businesses to pilot ideas, generate public relations opportunities and work directly with academies. Annually the consortium publishes a research output combining theoretical and didactic papers alongside a selection of students' work. The initiative is developing and

growing; increasingly undergraduate participants in the intensive international week are also working closely with Doctoral and Masters students, and active research groups.

Defining Commonalities – Collaborative Characteristics?

Figure 9: CHOBE Seminar Attendees and resulting shared learning points, 2015

The diversity and energy of the small sample of case studies above offer a snapshot of the huge variety of inter-disciplinary collaborative learning models currently offered within higher education in the UK and worldwide. It is hoped that the reader will be inspired by the short narratives presented above, find suggestion for development or enhancement of their own practices in the narrative descriptions of the projects. Participants in the original seminar reported developing an enhanced realisation of the various potentials offered by these projects; in industry engagement, research catalysis, tacit knowledge development and in building individual agency and confidence.

Each of the projects can be said to adhere to Wood and Gray's definition of collaboration, cited in the introduction to this study. A further observation is the presence, in each study, of what Wood and Gray name a *Convener*, an individual who offers "legitimation,… facilitation,… mandate, …[and]…persuasion" (Wood and Gray, 1991). The analysis of these roles with respect to the studies above found each action was necessary in every project cited, enacted as described in the short narratives above. The roles played by the tutor, as *Convener*, ranged between these strategies and an analysis of the reasoning behind these actions would be beneficial.

In addition to recognising characteristics and roles common to each project, these experiences revealed an understanding of the strategic importance of particular elements, applicable to many of the projects. Table 2 highlights some specific common characteristics apparent to the authors.

Table 2: Table comparing selected characteristics of Case Studies. Two characteristics are common to all projects studied.

It can be seen that:

- External industry practitioners are engaged, to an extent, in every collaborative learning project presented.
- Every collaborative project includes time spent off-campus; a discipline-neutral territory and an explicit 'application' of academic knowledge outwith the institution.
- Activities which are part of the curriculum are likely to use collaborative tasks as a precursor to assessed, individual disciplinary-specific tasks (e.g. not to assess the collaborative project itself).
- Several projects were generated in response to a call for innovative proposals to receive funding for developing or enriching the student experience.
- It is common to use a 'competition' format, perhaps as a means of establishing a common goal, engendering collaborative endeavour within teams.

Further observations, not highlighted above:

- Projects are likely to be designed and run by staff with significant experience in industry, either before or alongside their academic career.
- Several projects made explicit reference to literature on team roles and teamwork, in briefing or debriefing the participating students: for example, Belbin (ibid), Tuckman

(1965, 1977) or role theory (Edwards et al, 2009). These contextualisations situate the learning experience in a particular academic context; 'approaches to role theory differ in their orientation, as structuralists focus more on the social system/environment and symbolic interactionists are more concerned with individuals and micro-level interactions' (Michalec & Hafferty, 2015). Further research investigating the impact of this contextualisation would be valued.

The authors have enjoyed the opportunity of cross-pollinating their praxes through this study. The discovery of multiple definable commonalities between projects has resulted in a mutual interest in further developing a *taxonomy of collaborative learning*.

Enabling Collaborative Practice

The World Health Organisation asserts 'there are mechanisms that shape how collaborative practice is introduced and executed…. these have been divided into three themes: institutional support mechanisms…; working culture mechanisms…; and environmental mechanisms" (WHO, 2010). The enabling of these case study projects proved a significant discussion point for the authors, and again drew out a range of common experiences, and in this case, a series of recommendations. The WHO definition provides an apt framework for the organisation of our reflections on enabling and encouraging collaborative practice. The observations and recommendations of the authors can be distributed between these three categories: each of these are taken in turn, in twelve points for enabling collaborative projects in Higher Education Institutions, detailed below.

Institutional Support Mechanisms

- Set aside funding for cross-disciplinary activities.
- Actively support problem-based multidisciplinary research groups straddling disciplinary organisational structures (King, 2010).
- Recognise explicitly the value of collaborative skill development in assessment, e.g. 'soft skills', professionalism, etc. There are indications that increased emphasis on 'Graduate Attributes' may be developing this awareness, explored below.

Working Culture Mechanisms

- Assure mutual respect between disciplines and the development of a shared language between disciplines (essential in staff as well as students!).
- Actively seek out live projects and active professionals close to the institution. Trust these professionals to contribute in direct contact with students.
- Staff working on collaborative projects must themselves be comfortable with setting open-ended, complex briefs, the solutions to which they individually may not themselves understand. This uncertainty, essential to developing collaborative skills and professional judgement, can be difficult for academic specialists to accept.
- An understanding, gained through experience and a rigorous, responsive feedback loop, of the level of direction required to allow students to best perform and demonstrate their skills, and operate as a team, whilst gaining experience from operating in an environment of ambiguity.
- Recognise that the value of collaborative projects is best evidenced in the process rather than the output; this has implications for both task design and assessment.

Environmental Mechanisms

- Timetable management: Collaborative projects require synchronisation and disruption over multiple programmes. This can be extraordinarily difficult and requires proactive support.

- ‘Neutral’ Territory. The importance of introducing team members in an environment where each feel equally able to contribute.
- Recognise the importance of longitudinal engagement outwith academic semester timeframes in developing meaningful industry relationships (Eddy, 2010)
- Digital technologies enable intra-team collaboration in ways and to an extent unprecedented in traditional teamworking formats. HEIs must lead in introducing future professionals to these emerging environments to support industry skill development.

There is a strong link between the development of self-, intra-disciplinary and extra-professional teamwork skills, and a recent movement within UK HEIs to increase the emphasis on delivering ‘Graduate Attributes’ within curricular programmes (Oliver, 2013). These attributes, often incorporating ethical behaviour, teamworking, and the application of judgement to complex tasks, share much with the qualities of professionalism sought by the institutional criteria addressed earlier. Perhaps the HEI acknowledgement and promotion of these skills and values across multiple programmes will encourage further collaborative learning experiences, and effectively propagate the cross-disciplinary collaborative professional identity that siloed specialist educational experiences fail to deliver.

Conclusions

It is intended that this paper document a selection of successful initiatives in collaborative interdisciplinary education in built environment disciplines, alongside a commentary linking the practical examples with wider regulatory and academic literature. The paper has also identified practical and theoretical shifts that may be made to encourage more widespread use of such teaching and learning practices.

‘..the challenge for aspiring professionals is to develop the capability to use disciplinary knowledge, in conjunction with professional experience, as a resource in a specific context to pick out the salient features of that situation or event, and to then infer what follows and how to act’ (Guile, in Young and Muller, 2014)

Key to the success of this process is taking students [and academics] deliberately out of the institutionalized frameworks that bind them - frameworks that often, ironically, restrict innovation. To succeed in this interprofessional, intercultural collaboration requires improvisation, both in mind-set and in design technique, and requires a willingness to operate with uncertainty whilst embracing risk, and risking failure.

Design, and specifically co-design, are key skills in a world of rapid change and unpredictable unknowns. Professional roles in the built environment sector are rapidly evolving, and new formats of processes and transactions developing at an unprecedented rate. Successfully navigating this environment requires graduates with essential interprofessional skills, effectively acquired through collaborative inter-disciplinary projects in higher education. The conclusions of this UK-based study propose explicit ways in which these forms of collaborative professional education can be developed globally. The authors look forward to developing this dataset internationally, in partnership with others, and further defining a taxonomy of collaborative learning.

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