Preparing Graduates for Interdisciplinary Collaboration in the Workplace

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Abstract

This paper reports the findings of six focus groups on developing skills for interdisciplinary collaboration in Higher Education (HE), and our literature view. This work is associated with a Teaching Innovation Project that received funding from the authors' institution. This project aims to develop a systemic pedagogy for facilitating interdisciplinary collaboration, which is deemed critical for the delivery of Smart Cities, and to test and disseminate this pedagogy. The focus groups aimed to critically evaluate the current thinking and practice on inter-disciplinary collaboration from a different standpoint. The perceived wisdom that solely creating opportunities for interdisciplinary collaboration, e.g. live projects, as part of the curriculum, will develop practitioners who can collaborate across disciplinary boundaries, was challenged.

The use of group work for developing skills for collaboration is an established and well-researched pedagogical approach. However, far less attention has been given to the skills for *interdisciplinary* collaboration (Park & Mills 2014). Working in interdisciplinary teams presents a unique set of challenges. The transferable skills required to do this are increasingly recognised as crucial to respond to the complex sustainability challenges of the 21st Century (Marinova & McGrath 2004, Defila & Di Giulio, 2015), including the delivery of Smart Cities. Simply putting students in interdisciplinary teams is not sufficient to develop these skills (Ritcher 2009). Small-scale interventions and exploratory projects rather than embedded programmatic approaches, are needed (Klein & Schneider, 2010). Teaching strategies that promote the skills required for interdisciplinary collaboration should be developed (Ritcher et al 2009). We argue that learning and teaching for inter-disciplinary collaboration should place more emphasis on: shared (across disciplines) modules or lectures based on case or problem-based learning; and actively developing students' understanding of the dynamics of teams and personal relationships, and behaviours within teams; and their ability to effectively function in interdisciplinary teams.

Keywords: collaboration, inter-disciplinary, learning environment, boundaries, silos

1. Introduction

This paper reports the findings of six focus groups on developing skills for interdisciplinary collaboration in Higher Education (HE), and our literature view. The aim of the focus groups was to establish the current thinking and practice on fostering interdisciplinary collaboration in the participants' institutions and departments. The focus groups were delivered as part of an international conference on teaching and learning in Architecture, and an internal conference at the authors' institution that focussed on employment and entrepreneurship. This work is associated with a Teaching Innovation Project that received funding from the authors' institution. The first set of focus groups paved the way to the funding of this project, and the second set was delivered as part of it.

This project aims to develop a systemic pedagogy for facilitating interdisciplinary collaboration, which is deemed critical for the delivery of Smart Cities, and to test and disseminate this pedagogy. The focus groups aimed to critically evaluate the current thinking and practice on inter-disciplinary collaboration from a different standpoint. The perceived wisdom that solely creating opportunities for interdisciplinary collaboration, e.g. live projects, as part of the curriculum, will develop practitioners who can collaborate across disciplinary boundaries, was challenged.

The next section reports the findings of our literature review on developing collaborative skills in HE. The approach to running the focus groups is described and justified, before findings of the focus groups are presented and discussed.

2. Literature review

Our review highlights a significant absence of theoretical justification for the role of group based active learning strategies in the teaching of interdisciplinary collaboration. This points to a lack of guiding theoretical principles behind interdisciplinary teaching strategies. Interdisciplinary teaching is growing in importance but is held back primarily by institutional barriers. Despite this, many Universities offer opportunities to engage in interdisciplinary learning and key learning outcomes have been identified. However, despite the presence of a range of strategies to teach interdisciplinary skills and the establishment of learning outcomes, there is a paucity of empirical evidence on whether these various strategies actually promote interdisciplinary skills. This points to the absence of evaluative criteria and understanding of the key principles and epistemologies that should inform group-based active learning approaches.

In 2015, the Higher Education Academy (HEA) published a report on interdisciplinary teaching in higher education which began with the question 'Is interdisciplinarity the new zeitgeist for higher education (HE)?' (Lyall et al., 2015:5). Whilst the importance of interdisciplinarity is reasonably well established in the field of research, its role in teaching in UK HE has received far less attention. This is now changing rapidly driven by a questioning of whether Universities are properly preparing students for a changing world. It is recognised that addressing the "wicked problems" of the 21st Century, complex real world problems that necessitate the insights of more than one discipline, requires graduates who can transcend disciplinary boundaries, work collaboratively and handle complexity (Marinova & McGrath 2004, Siedlok and Hibbert , 2014, Defila & Di Giulio, 2015, Lyall et al. 2015). On top of this, the growing focus on employability in UK HE is drawing more attention to the needs of employers for creative, agile learners who are better prepared for the realities of the workplace with the skills to work effectively in multi-disciplinary teams (Lyall et al., 2015).

Moving towards more interdisciplinary practices is not however seen to be an easy move for HEIs. Blackmore and Kandiko (2012:77) describe it as 'one of the more contentious curriculum issues'. The

literature identifies a number of key challenges for HEIs, categorised by Chettiparamb (2007) into 'institutional problems' and 'people problems'. At the centre is the institutional structure of Universities which have traditionally delivered teaching in discipline focused departments. This structure entrenches differences between disciplines whilst also creating procedural barriers that discourage collaboration across disciplinary units (Kember, 2009; Pharo & Bridle, 2012; Russell, Wickson, & Carew, 2008 cited in Pharo, 2014).

Interdisciplinary courses also pose a challenge for staff particularly in a context where institutional support for collaboration is lacking. In Lyall et al 's 2015 survey of HEI provision three quarters of the programme director respondents agreed that 'most academic staff simply wish to teach their usual modules in familiar subjects and not become involved in synthesis' (Lyall et al 2015:8). This is understandable, there can be substantive barriers to overcome. These barriers have been acknowledged in teaching and learning (Kuykendall and Kemp, 2016); and in practice (Huxham and Vangen, 2004). Differences in the 'ways of knowing' in different disciplines, the difficulty of establishing a common aim and objectives, and the lack of trust, at least initially, are widely reported amongst the barriers. Explanations given for a lack of cross-disciplinary teaching initiatives in HEIs include faculty competition for resources, differences in pedagogy and practice, discipline specific protectionism, differences in faculty workloads and departmental concerns about power and control (Dyer, 2003, Pharo, 2014).

Despite these barriers, an increasing number of HEIs have been creating specific opportunities for students to engage in interdisciplinary learning. These have not gone as far as the US where interdisciplinary courses have become a standard feature of the curriculum but nevertheless they form an element in many institutional strategies with some disciplines in particular, engineering and medicine being more advanced than others (Lyall et al., 2015; Richter, 2009; Morton et al.2010). These take various forms including extra-curricular interdisciplinary research projects and live projects, University wide non-credit bearing courses tackling global challenges, interdisciplinary cross-faculty modules and many active learning approaches. Lyall et al (2015) categorise teaching strategies which were variously described as "interdisciplinary" in the literature into three groups: co-teaching in interdisciplinary teams, interactive methods and programme-level strategies such as core interdisciplinary courses. Within the literature there is a particular emphasis on active learning including experiential project work; problem-based learning, case study methods, role-playing, simulations, virtual methods, peer-assessment and review and peer-assisted learning (PAL) (Newel and Luckie, 2012; QAA/HEA 2014; Lyall et al 2015).

Alongside a range of teaching strategies, the literature also points to key learning incomes to promote student development of the skills required for interdisciplinary collaboration. Key interdisciplinary competences are identified as "an ability to synthesise, appreciation of diverse perspectives, and flexible, critical thinking" (Lyall et al 2015:viii). Others stress the importance of higher order critical thinking skills, meta-cognitive reflection, problem-solving and analysis and synthetic thinking skills (Chettiparamb 2007, Haynes and Leonard 2010 cited in Lyall et al, 2015).

Whilst the field of interdisciplinary teaching has both teaching strategies and learning outcomes, crucially there is little empirical evidence or debate in the literature of the extent to which these various learning strategies are successful in promoting interdisciplinary competences. This reflects a lack of evaluative research and a general sparsity of literature dedicated solely to interdisciplinary provision in higher education (Lyall et al, 2015) More significantly Lyall et al argue that what is missing from the literature is sufficient theorising about pedagogy in this developing field of teaching practice suggesting "that theory has not yet caught up with practice in this field" (2015:10) The lack of a theoretical underpinning is symptomatic of fact that interdisciplinary teaching often takes place at the margins of mainstream teaching, sometimes on an ad hoc or experimental basis and often in the form of integrative programmes situated outside of conventional disciplines (Franks et al., 2007; Golding, 2009 cited in Pharo 2014). This contributes to the absence of embedded systematic approaches to the teaching of interdisciplinary skills.

The absence of a clear set of principles and epistemologies means that there are at present no agreed guidelines in HEI for creating an interdisciplinary programme. In their review of interdisciplinary projects across nursing programmes in UK Universities, Cooper et al (2001) also found that a lack of theorising meant that the majority of projects did not have any theoretical basis behind the decisions to use specific teaching method. This is particularly evident in the context of teaching methods where team work and collaboration around live projects, role players and group-based problem learning activities play a central role. It has long been recognised in the field of group work, that simply putting students into teams is not sufficient to teach group work skills. Students need support and guidance on how to work effectively (Richter, 2009) and a considerable body of research now exists on pedagogy of group work. However, similar principles apply to interdisciplinary team work: students will not learn skills in interdisciplinary collaboration simply by being put into interdisciplinary teams or working on interdisciplinary problems (Richter, 2009). What is needed is specific skills teaching based on an evidence- based understanding of pedagogies that promote interdisciplinary competences.

3. Methodology

The seven focus groups that yielded the data which is presented in this paper are part of a two-year Teaching Innovation Project. They were held as part of an international and an internal conference. Both conferences focussed on teaching and learning in HE. This decision to run the focus groups as part of two different conferences was mainly driven by operational needs to reach out to interested parties as easily and as quickly as possible. The first conference provided the opportunity to capture an international audience. These operational benefits are counter-balanced with the risk of bias as the participants are self-selecting teaching professionals who have demonstrated their interest in inter-disciplinary collaboration in HE by deciding to attend these two conferences.

Focus groups were chosen as an appropriate data collection tool because the aim was to capture in-depth information on the participants' practices and to generate a discussion among the group. The focus groups were designed and run by a multi-disciplinary team of academics with backgrounds in architecture, urban design, civil engineering, construction, land management and infrastructure development policy. They started with a 'reverse (or negative) brainstorming' session, which combined brainstorming with reversal techniques.

Groups of participants were asked to devise an education system for the built environment sector. They were invited to generate scenarios as to how they could make it almost impossible for students to share ideas and work effectively together. They were asked to respond to the following question during this phase of the discussion:

> How you could make it almost <u>impossible</u> for students to collaborate, i.e. share ideas and work effectively together, across different disciplines?

Each group then reported one idea at a time. The convenors mapped these ideas live as mind-maps. The groups then worked in reversal mode to turn their original scenarios into those that would foster inter-disciplinary collaboration. They were posed the following question:

> How you could make it <u>possible</u> for students to collaborate, i.e. share ideas and work effectively together, across different disciplines?

Each group presented their 'solution' to others as part of the general discussion. The purpose of this discussion was to identify which aspects of inter-disciplinary collaboration HEIs should focus on. These ideas were also mapped live.

The researchers analysed the mind-maps using content analysis techniques. The themes that are reported in this paper emerged from this analysis.

4. Analysis and Discussion

Table 1 shows the themes that emerged from the seven focus groups. The themes range from assessment, curriculum design and culture to the nature of the problems the students need to solve, resources, and the structure of the HEIs and the courses. The focus groups yield similar findings to our literature review. The skills that are necessary to collaborate across different disciplines as a theme in only two of the seven focus groups. Appropriate pedagogic approaches to foster inter-disciplinary collaboration emerged in only one of the focus groups.

Institutional structures, resources budgets and financial arrangements are frequently cited as barriers to interdisciplinary collaboration in HEIs. Spatial dimensions of separation of academic disciplines and lack of spaces for staff and students from different disciplines to intermingle informally, to have 'chance encounters' and discuss potential collaboration, as well as professional accreditation of the courses, are also included among the barriers. The professional bodies are seen to be strengthening the disciplinary silos as a result of their lack of collaboration and coordination in terms of their educational frameworks that underpin accreditation. Culture that underpins attitudes and behaviours of different professions including their routines and stereotypes, emerges as one of the barriers to engagement with other disciplines. Some participants refer to the stereotypes resulting in dislike of other professions.

Nature of the problem emerged as a theme in six of the seven focus groups. Participants referred to it both as a barrier and as an enabler of inter-disciplinary collaboration. They agreed that complex problems that require input from a number of disciplines are effective means to fostering collaboration. Following the discussions on the nature of the problem, assessment emerged as a theme in five of the seven focus groups. The focus of the discussions on this theme was the need to value the engagement with the collaborative process as well as the output of that process.

In their response to facilitating collaboration across different disciplines, the participants highlighted the need to help student understand disciplinary cultures and languages. The difficulties associated with understanding and speaking the language of different disciplines emerged as a barrier at the earlier phase of the discussions in more than half of the focus groups. It is therefore natural that developing an understanding of disciplinary languages emerged as one of the ways in which collaboration can be encouraged. A move towards the abolition of departments to eliminate structural boundaries, which also manifest themselves in the allocation of financial and human resources, was also suggested as an enabler.

Overall, it is interesting to note that the discussions in each focus group centered around bringing people together and overcoming the perceived barriers to doing so. Conditions that created boundaries, e.g. organisational structures, disciplinary languages, were frequently mentioned among the barriers that need to be overcome. It could thus be argued that the focus group participants also share the view that was prevalent in the literature that bringing students together in multi-disciplinary contexts was enough for them to collaborate fellow students studying other disciplines. This finding provides further justification for our Teaching Innovation project which aims at developing a systemic pedagogy for facilitating interdisciplinary collaboration initially within our School.

Table 1. Focus Groups Emergent Themes

	How you could make it almost **impossible** for students to **collaborate**, i.e. share ideas and work effectively together, **across different disciplines?**	How you could make it **possible** for students to **collaborate**, i.e. share ideas and work effectively together, **across different disciplines?**
Focus Group 1- 1	**Assessment**: restrict assessments to specific disciplines, nurture competitiveness **Communication**: language/ jargon/restricted set of references **Culture**: sense of disciplinary hegemonies, impose specific dogmas/beliefs/ stereotypes/ culture/clichés/ behaviours , exclude other disciplines, Sense of individual entitlement. **Curriculum**: restrict choices/ methodologies , restrict outcomes, inflexible time/schedule **Resources**: funding constraints/differences **Skills**: lack of collaboration skills **Spatial aspects**: spatial constraints (no place to meet), **Structures**: silos/restricting ownership of disciplines & groups, restricting subject matters, nurture disciplinary protectionism/ accreditation	**Assessment**: celebrate experimentation and open outcomes, assess learning NOT outcomes **Culture:** readiness to engage beyond design disciplines, promote diversity from start, avoid talking about disciplines (at least initially). **Curriculum**: competence based learning. **Nature of problem**: Share a subject/problem/issue. **Resources**: create a common ground (may be about organising space), offer expertise around common shared goals
Focus Group 1- 2	**Communication**: use jargon as a barrier to communication, e.g. use only acronyms, discourage communication with others **Curriculum** : professional accreditation **Culture**: foster discipline-specific routines, wear attire that resembles uniforms, e.g. architects with back polo necks.	**Assessment** : overcome fears about assessment, assess learning and engagement with the process not just the output/outcome **Culture**: social, exciting opportunities to bring different disciplines together, chance encounters between different disciplines, acknowledge/value conflict, value learning, have a life outside the discipline **Curriculum** : teach to listen, develop skills to listen **Skills**: develop social skills to engage outside the discipline. **Structure**: Oxford-style college model.

Focus Group 1- 3	**Assessment**: Punish innovative responses to assessment **Culture**: Foster supremacist roles and stigmatisation **Curriculum**: overload students, do not allow time for extra-curricular activities **Nature of the problem:** devise discipline-specific tasks, set requirements that do not need input from other disciplines **Resources**: Discipline-based funding **Structure**: design modular courses	**Curriculum**: let other stakeholders set the scenarios, not just academics, input from stakeholders to programme design, feedback on the programme from stakeholders, continue the virtuous circle of programme design and feedback from stakeholders
Focus Group 2- 1	**Assessment**: narrow assessment criteria **Communication**: lack of ("no-discussion/ interaction"), keep events apart **Culture**: professional identity, roles, labels **Human Resources** (reward): do not reward staff who get involved in inter-disciplinary teaching initiatives **Nature of the problem**: wicked problems, too-specialised problems ("drilling down too far"). **Resources**: limit availability & access **Structure**: hierarchical organisational structures, department-silo-based approach to staffing.	**Curriculum**: time-tabling **Human Resources**: staff with diverse backgrounds, open-minded staff, a reward system that recognises working on fostering inter-disciplinary collaboration and that rewards teaching, shared ownership & authorship (wrt to reward), team-players. **Resources**: distribution between the different faculties/departments **Structure**: the organisational structure, resolve conflicts of interest
Focus Group 2- 2	**Curriculum**: time-tabling, single-subject focus, learning outcomes **Evaluation & recognition of teaching**: metrics (e.g. definition of employability), senior level understanding of these. **Human Resources**: type of staff (e.g. some are motivated and some aren't), how researchers are rewarded (if you are a high-flying researcher, it is not in your interest to collaborate). **Nature of the problem**: 'closed' problem, **Resources**: availability & access (money in this case) **Structure**: the organisational structure (departments), research structure & opportunities, **Spatial Aspects**: teaching spaces	**Curriculum**: loose/no learning outcomes, negotiated learning outcomes, co-creation **Demonstrate the value of collaboration**: for example increased employment prospects, Influencing inter-disciplinary agendas beyond the institution: e.g. EEUK **Human Resources**: job descriptions reflecting the expectations for collaboration **Nature of the problem**: wicked problems, shared project briefs, **Structure**: the organisational structure (no departments)

Focus Group 2-3	**Communication**: encourage specialised language and language barriers, restrict communication & access across areas, encourage lack of clarity about how different disciplines interact, present difficulties to network-building. **Curriculum**: devise separationist curricula, Resources: create competition for resources, do not assign funds **Nature of the problem**: focus on small specific issues rather than the bigger picture. **Pedagogic approaches**: lack of appropriate ones, **Spatial aspects**: physical separation of campuses, **Structure**: keep teams small and with very specific expertise, keep management of different disciplines separate.	**Assessment**: recognise achievement, publicise **Communication**: encourage dialogue across boundaries (disciplinary, departmental, etc.) **Curriculum**: dedicated events. **Pedagogic approaches**: encourage questioning/criticality, encourage sustainable collaboration system. **Resources**: make funding, champions available **Spatial aspects**: shared spaces
Focus Group 2-4	**Culture**: professional Identity, foster a culture of disciplinary ghettos, reinforcing cohort identity **Curriculum**: deliver collaboration as part of the curriculum, slot it into modules, ghettoization of students from early on **Human resources**: lack of flexibility/adaptability by senior people (lecturers)	**Human resources**: some students could be too stretched due to quality issues, personalities of the educators **Nature of the problem**: consultancy-type projects, structure of the activity that the students are given

5. Conclusions

This paper reported on our literature review on fostering interdisciplinary collaboration in HEIs and the seven focus groups that were conducted to establish current practices in the participants' institutions. Our literature review has highlighted the lack of a clear set of principles and epistemologies, which lead to a lack of agreed guidelines in HEI for creating an interdisciplinary programme. It has also identified that the need to develop the skills for interdisciplinary collaboration is largely overlooked in the literature. Our focus group findings corroborated these findings. These outcomes strengthen the case for our Teaching Innovation project, which has been running since September 2018. The next phase of our project is to conduct an institution-wide review of the existing practices and to involve students and industry in their evaluation. These stakeholders will also be involved in devising an effective approach to developing interdisciplinary skills. This approach will be tested during the 2019-2020 academic year as part of a number of modules in our School.

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