ROLE OF MULTI-DISCIPLINARY PROJECT STUDIES IN PROMOTING SUSTAINABILITY WITHIN THE BUILT ENVIRONMENT DEGREE PROGRAMMES

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ABSTRACT

The need to contribute to the sustainability agenda is increasingly becoming a key requisite for both academics and practitioners in the built environment disciplines. The triple bottom line indicators of sustainability involve the consideration and collative optimisation of environmental, social and economic aspects of projects. Therefore, it is of vital importance that the current and future built environment professionals are able to ensure that they provide sustainable built environment solutions. Higher education institutions which offer built environment degree programmes use different approaches to achieve this requirement. Multi-Disciplinary Project Studies (MDPs) have been identified as a way of imparting such knowledge and practices for the built environment students.

The principal aim of this paper is to discuss two approaches in delivering multi-disciplinary projected studies adopted in two higher education organisations in the UK. Firstly, the paper aims to identify the key components of the sustainability agenda, while explaining how the delivery of multi-disciplinary project modules can be contributed to it. Secondly, it discusses two different approaches for multi-disciplinary projects and analyses how each approach contributes to imparting the skills and knowledge to develop sustainable built environment solutions. Finally the opportunities opened up challenges encountered in both models, and the implications to teaching and the industry practices are discussed. A literature review on pedagogical teaching and participant observations were the main methods used to collect data. The preliminary findings indicate the positive role of the MDPs in contributing to the sustainability agenda. Further research and innovation is required to overcome the challenges of organisation and assessment, and greater integration with Building Information Modelling (BIM).

Keywords: *Built Environment; Collaboration; Higher Education; Multi-Disciplinary Projects; Sustainability; Teaching.*

1. INTRODUCTION

The need to contribute to the sustainability agenda is increasingly becoming a key requisite for both academics and practitioners in the built environment disciplines. Locke *et al* (2009) points out that the United Nations Decade of Education for Sustainable Development (2005-2014) has highlighted the importance and the vital need to incorporate sustainable development within teaching and learning. As a result, higher education institutions (HEIs) are increasingly focusing on sustainable development as a one of significant components in their activities, while the Higher Education Funding Council for England (HEFCE) has adopted this approach and outlined a range of performance targets for universities.

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This paper focuses on two different approaches for conducting multi-disciplinary projects in two higher education institutions in the UK, while explaining how those approaches fit with the sustainability agenda.

2. AIM AND OBJECTIVES

The principal aim of this paper is to discuss two approaches in delivering multi-disciplinary projected studies adopted in two higher education organisations in the UK. Firstly, the paper aims to identify the key components of the sustainability agenda, while explaining how the delivery of multi-disciplinary project modules can be contributed to it. Secondly, it discusses two different approaches for multi-disciplinary projects and analyses how each approach contributes to imparting the skills and knowledge to develop sustainable built environment solutions. Finally the opportunities opened up challenges encountered in both models, and the implications to teaching and the industry practices are discussed.

3. RESEARCH METHODOLOGY

Several research methods have been used in preparation of this paper. Literature reviewed on sustainable development and higher education sector's contribution to the sustainable development enabled the establishment of the background and the rationale for the paper. In addition the teaching and learning literature strengthened the discussion on the opportunities, challenges and implications section. Participant observations of multi-disciplinary project modules paved the way for obtaining the empirical data for this paper.

4. FACTORS THAT NEED TO BE CONSIDERED TO FULFIL THE SUSTAINABILITY AGENDA

The Rio Declaration highlighted the importance of collaborative efforts from the teaching, research and business sectors in achieving the overall sustainability agenda. Leadership, Learning and Teaching, Practice within HEI, partnership and community working, and research are indicated as avenues through which higher education sector can respond to the challenge (Welsh HE Institutional Group, 2010). According to Sterling (2011) education for sustainable development can be broadly termed as education, teaching and learning that appear to be required if we are concerned about ensuring social, economic and ecological well-being, now and into the future. The UK's Higher Education Academy (HEA) is contributing to the suitability agenda by aiming to help higher education institutions in the development of sustainability literate graduates who have the skills, knowledge and experience to contribute to an environmentally and ethically responsible society. The HEA also acknowledges that in attempting to meet this challenge, the traditional pedagogies may be challenged, and requires a multi-disciplinary partnership approach across and between institutions (Higher Education Academy UK, 2014). There is evidently a need for stronger commitment to implement Education for Sustainable Development (ESD) and to implement the changes needed to achieve the performance targets set out by HEFCE (Locke *et al*, 2009).

Sterling (2011) noted that Education for sustainable development is flourishing in universities where it is embedded in the curriculum, part of the culture of the university, seen in relation to (rather than separate from) other agendas such as employability, internationalisation and enterprise, linked to sustainability initiatives and learning in the wider community. Furthermore he points out that the wider context and employment where there is a need for HE to both respond to and help shape real-world conditions, policy and mandate, the expectations from funding councils, and increasingly, from HEI senior managers, education and quality, where quality and innovative teaching and learning as some of the rationale for engaging in education for sustainable development.

The national curriculum highlights the need to educating students to think creatively and critically to solve problems and to make a difference (Department for Education and Employment 1999 in Wade 2002).

Education must also support the ethos of sustainability as students' attitudes to the environment are difficult to change (Wade, 2002; Locke *et al*, 2009)

In broad terms, sustainability focuses on three main themes; social; economic and environmental accountabilities, which are often referred to as being the 'triple bottom line' (Hall, 2011). Sustainable development encompass social progress, environmental protection, improved use of resources, employment and economic growth, and economic stability. The Built Environment (BE) and construction related work involve a series of team based, integrated multi-disciplinary activities. The construction industry has been blamed for its fragmented nature and the lack of integration in its processes and practices for a considerable amount of time. Therefore, group based problem-solving assessments within the BE curriculum is always encouraged (Morgan *et al*., 2004, Lam 2008) to ensure that students are acquiring required skills before they enter into the construction industry. In the above light, multi-disciplinary projects (MDPs) are seen as a way of imparting the knowledge of sustainability. The MDPs provides the opportunity to integrate the various built environment disciplines at the higher education level. As such technical, economics and managerial (people) skills which are essential in the quest for developing sustainable solutions can be incorporated in a real-life setting.

5. APPROACHES FOR MULTI-DISCIPLINARY PROJECT MODULES

Built Environment (BE) and construction related work usually involve multidisciplinary activities to complete a project. Due to the involvement of team work in most of the BE related projects, literature within the BE emphasis the need of group based, problem-solving assessments (Lam, 2008; Morgan *et al*., 2004) so that students can train to acquire skills related to team work. Group based assessments are promoted due to their advantages such as students gaining experience of working in teams, students can discuss and learn from their peers, students finding group work as more enjoyable and interesting (Miller *et al*., 1998; Garvin *et al*., 1995), appreciation of different opinions and views of peers (Collier, 1986). In this paper, two approaches used in two UK higher education institutions are presented and implications discussed.

5.1. THE THROUGH-SEMESTER APPROACH

In this approach, a module titled Multi-Disciplinary Projects (MDP) is conducted involving undergraduate students from disciplines namely Construction Project Management, Property Management and Investment, Quantity Surveying, Building Surveying and Architectural Design Technology). Students engage in the project activity during a full semester (approx. 12 weeks). However, the allocated time for this in a week is approximately 3 hours. Students are provided with a real-life problem based scenario, often a project benefiting the community, and the students are required to find solutions by working in groups. Miller *et al*. (1998) highly recommend the use of real cases from industry for group based assessments. As the scenario for the assessment was based on the real-life case, module delivery was done through a series of guest lecturers from the industry. Questions and answer sessions are also introduced during the module with the industry practitioners. This module has always been intended as the platform to provide the students with the opportunity to allow working in multidisciplinary groups mimicking the multi-disciplinary nature of construction projects (Keraminiyage, 2013). Expected outcomes from the students are designs according to the client's brief, demonstration of consideration of theories and principles thought in other modules, cost estimates including whole life costs, environmental considerations, and development appraisals providing guidance on funding arrangements. The overall submission forms a considerable portion of the planning application that the particular community project client requires to submit to the local authority to obtain planning permission. Keraminiyage (2013) observes that from the very beginning, the client is expected to work closely with the students and generally there would be a live question and answer session organised as a part of the module, so that the students can get clarifications to any of their queries directly from the client. In addition, few site visits would generally be organised, so that the students can get a feeling about the actual project context. Mode of delivery for this module is largely through specialised guest lectures from the industry experts and directed group activities. Industry experts covering all aspects of the project (architectural, quantity surveying, etc.) are invited and agreed upon, at the beginning of the semester, to deliver guest lectures.

The assessment requires the students to submit a consist of a project execution plan, an interim group presentation and a final group presentation assessed on a group basis and marks adjusted for individual

members based on an effort log scoring system by peers, and in the final week of the semester an individual reflective commentary about the individual and group contributions to the project (Keraminiyage, 2013). The assessment team also comprises of a group of tutors representing different disciplines. The assessment is structured in such a way that coordination and input are required to complete the assessment. Further, some aspects of the assessments (mainly the presentations done by the students) were assessed with the involvement of industry practitioners.

5.2. THE PROJECT WEEK APPROACH

In this approach, the students design and construct a building or a related infrastructure on an experimental construction site (http://www.constructionarium.co.uk/). Students are required to be resident within the construction for the entire project duration. Two such project weeks are conducted per year. The teams are made up of members from different construction industry disciplines such as Quantity Surveying, Building Surveying, Construction Management, Architecture and Civil Engineering. Students are required to design and construct structures within controlled cost, time and quality targets. Refer http://www.youtube.com/watch?v=zWGTtO6KkyI for further information.

Teams formed by the academic staff. The assessment brief requires the students to design and construct an already existing structure but at a much lesser scale. The students interact closely with practising professionals. The industry professionals belonging to the various subject disciplines are also involved in the assessment and feedback process.

Whilst many education theorists, academics, construction professionals, and students themselves point out many advantages of such project work built-in modules, there are a number of challenges that can be identified within the Multi-Disciplinary Projects (MDP). These challenges mainly stem from the academic practice point of view, and the successful addressing and management of these challenges are a key determinant of success when seen from a higher education teaching practice performance perspective.

6. DISCUSSION: OPPORTUNITIES, CHALLENGES AND IMPLICATIONS

MDPs provide an excellent opportunity to facilitate problem based learning and also to provide formative feedback. Wood (2003) pointed out that teamwork, chairing a group, listening, recording, cooperation, respect for colleagues' views, critical evaluation of literature, self-directed learning and use of resources and presentation skills as generic skills and attitudes fostered by problem based learning. These assessments are always promoted within the curriculum due to their advantages such as team work, learning from the peers, students enjoying their work (Miller *et al*., 1998); appreciation of peer opinions (Collier and Clarke 1986), and encouraging student autonomy (Freeman 1995, Biggs 2001). MDPs in this context allow the students to gain most of these, thereby giving them the much needed employability skills. The module helps to develop students' knowledge and understanding about the subject due to rich feedback received from academics, professionals and clients; interactive and deep learning (Biggs 2003).

Moreover, different types of assessment methods used for MDPs further contribute to creating a rich assessment and feedback strategy. In addition, feedback for MDPs is offered by different parties ranging from peers, academics, professionals etc. Furthermore, these modules provide such opportunities for professionals and clients within the built environment sector to contribute to the assessment and feedback at the university level in inspiring students to believe that the classroom activities can actually be made to work in the real world. Therefore, MDPs create a good opportunity to revisit and further enhance the role that the various regulatory bodies such as Higher Education Academy (HEA), Royal Institution of Chartered Surveyors (RICS), Royal Institute of British Architects (RIBA), and the Institute of Civil Engineers (ICE) etc. could play a vital role in enhancing the teaching and learning process of the students in the BE sector, especially with regard to proving them with key professional knowledge and skills.

However, the MDPs present many challenges in a multitude of ways. MDPs are complex in nature due to number of reasons. The MDPs enrol a diverse group of students. The involvement of students from different disciplines within the BE sector sometimes create an "intra-discipline blame culture" as oppose to "appreciation" of other discipline's work. Furthermore, as in any student cohort, the students involved in this module are diverse based on mode of study (full-time, part-time division); experience; maturity; expectations etc.

Different types of assessment methods (written reports, verbal presentations, questions and answer sessions, design critiques, field observations, reflective commentaries etc) are used for MDPs presents challenges in terms of timing of assessments, managing student and staff workload, and the extent of feedback given for assessments. Furthermore, capturing feedback given by different parties in diverse formats (written / verbal / rubric / virtual workspace) and bringing them to a common platform has been identified as an issue which has hindered the effectiveness of the rich feedback given during the MDP process.

Team work is an integral part of MDPs. However, when it comes to allocation of marks, students may not always find the outcomes satisfactory always. For example "free riders" (Brooks and Ammons 2003); lack of fair allocation of marks based on individual contributions (Heathfield 1999); impact of weak students on high performing students (Kember *et al*., 1996); and also inconsistent marking of tutors (Lam 2008) are some of them. These issues can be further complicated when combined with the involvement of large number of students; diversity of the student population (full-time, part-time, experienced, international); number of assessment and feedback (A and F) methods etc. In many instances peer reviews can be used to address "free riders" (those who doesn't contribute to group work) and "sucker effect" on better performing students (good students not performing due to "free riders" of the group hence producing less quality output).

Another challenge encountered in the MDPs is the role and the attitude of the tutors. Problem based learning creates environments where not only the students but the tutors learn as well. However, effective utilisation and benefit realisation of such opportunities occur only when the tutors dedicate fully. The various performance indicators that academics in the higher education required to gain (i.e. research, enterprise activities) sometimes results in MDPs being seen as extremely resource intensive.

Therefore, the assessment and feedback framework need to be developed for designing, delivering and managing MDP assessments whilst achieving the academic rigour, integrity and needed compliance with Quality Assurance purposes. Furthermore, appropriate mechanisms are required to develop to compile the various forms of feedback from MDPs to a single platform, which will facilitate the tutors to evaluate students performances based on the comments given at different stages of the module. This of course ensures the academics to give appropriate marks for the students on an evidence-based, rigorous process. Having said that it is expected that those mechanisms would help to improve the effectiveness of the formative feedback given, which will in turn further improve the students' work to the required standards. Also, given that there will be a number of examiners contributing to assessment; and they are expected to help achieving consistency by improving the moderation / internal verification process.

Other problems include lack of performance of some students resulted in whole team struggling to complete the task, delay in carrying out some discipline specific task making an impact on other disciplines to complete their tasks (for example, when ADT students do not prepare drawing on time, this had a knock-on effect on the QS students to cost the project) and the challenge of managing a large group of students in terms of delivery, assessment and feedback. Keraminiyage (2013) reported significant benefits that the MDP module brings to the community. The local community benefits from access to free expert advice and guidance on their construction projects including many alternative solutions addressing their requirement, thereby giving them a wide choice for selection. It also acts as a conduit for the industry to engage with community projects, thereby contributing to the corporate social responsibility item in their agenda. Academia-Industry collaboration is also enhanced.

Students' learning and satisfaction is a key priority in higher education. In this regard assessment and feedback for this module plays a key role. As feedback is provided by a variety of sources including the professional practitioners within the Built Environment (BE) sector, students value such feedback as they come from the real life practitioners. Therefore, the student learning experience is improved with appropriate feedback discussions with professional. Therefore the assessment and feedback strategy should consider to maximise the real life experience obtained from the stakeholders (client, professional employers), which will improve student learning experience and build up their confidence is managing actual construction project when they are graduated.

This discussion emphasises the real need of introducing MDP projects within the BE sector. The success and the impact of this study will be measured during the project lifecycle through different performance indicators (e.g. World of Work skills). The student engagement will be given the somewhat high prominence. The informal observations by tutors and steering group on MDPs will be used to study the

group cohesiveness and synergy which of these dimensions of student engagement are not readily quantifiable but identified as highly important in higher education agendas.

Surpless and Bushey (2012) offer some of the good practice suggestions. These include planning the assessment framework at the early stages of the project brief development, maximising the number and type of assessments to enrich the learning environment (within the resource constraints of the organisation) and build in feedback mechanisms including formative evaluation and finding ways to integrate assessment of project activities with existing course / institutional tools.

Furthermore, as a future action it is an absolute necessity to incorporate Building Information Modelling (BIM) with the Multi-Disciplinary Project modules. BIM can be seen as the technical and managerial platform powered by the advent of Information and Communication Technologies (ICT) to manage design and construction of built facilities. It facilitates and encourages multi-disciplinary working. With the UK government's directive to use BIM on all government projects by the year 2016, the above mentioned combination of BIM and MDP will create an attractive learning and teaching environment with powerful and user-friendly tools to provide both formative and summative feedback.

7. CONCLUSIONS

The need to impart knowledge and skills which contribute to the overall sustainability agenda has been well recognised. High level policy documents encourage the higher education sector as well the built environment sector to play their part in this regard. Given the fragmented nature of the construction industry, the Multi-Disciplinary Project approach in built environment higher education programmes provides an opportunity to make a significant contribution towards the sustainability agenda.

Higher education institutions employ various approaches to conduct multi-disciplinary projects in their built environment programmes. This paper presented two such approaches, namely the through-semester approach and the project week approach. Both approaches provide strong opportunities to impart knowledge and skills required from the built environment perspective to contribute to the sustainability agenda. The strong community engagement and multi-point assessment are key features of the through-semester approach. The construction site based nature, and the rapid assessment and feedback is a strong feature in the project week approach. Both approaches are well received by the students and the employers, in spite of the challenges encountered in terms of organisation and assessment.

As Building Information Modelling (BIM) becomes a key part of the future construction industry, the Multi-Disciplinary Project based nature of working will be a key requisite. Therefore, it is highly likely that the design and delivery of built environment in the future will be founded on Multi-Disciplinary approaches. Given the impact that any negative student experience is having on performance measures such as the National Student Survey (NSS), further research and innovation is required ensure that higher education institutes are able to strengthen their ability to provide the students a with positive multi-disciplinary learning experience.

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