Incorporating Building Information Modelling learning on BSc(Hons) Quantity Surveying & Commercial Management programme at Ulster University

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Abstract –

Building Information Modelling (BIM) is beginning to have a significant impact on the role of the quantity surveyor in consultancy and the commercial manager in the contracting sector. This will create many challenges for both, but will also provide opportunities to diversify and innovate that will ultimately lead to major changes in the roles. The aim of this paper will be to highlight the relevance of BIM to the quantity surveying and commercial management professions. It is imperative therefore, that the education of QS students embraces and embeds BIM within the curriculum and a detailed case study of how Ulster University has embedded BIM within the programme will be provided. This will illustrate how BIM is being taught both as a theoretical concept and subject and also as a practical skill to ensure that graduates entering the workplace can understand and also utilise BIM in practice. The presentation will also outline how members of the course lecturing team through their PhD research and academic enterprise will facilitate further embedding of BIM in the course curriculum..

Keywords – BIM, EDUCATION, LEARNING, CURRICULUM, COLLABORATION, IMPLEMENTATION

I INTRODUCTION

The aim of this paper is to outline how Building Information Modelling (BIM) learning has been embedded on the BSc(Hons) Quantity Surveying & Commercial Management programme at Ulster University.

Building Information Modelling (BIM) is increasingly becoming a process and technology used in the management of construction projects (Puolitaival & Forsythe, 2016). BIM is largely concerned with the collection of data that can be structured for reuse on future projects through their life cycle by providing information to support and improve quality and decision making during the design, construction and operational phases (Pittard & Sell, 2016). Therefore, in comparison to a traditional project, executing a BIM project requires expertise which in turn creates a need for graduates to be knowledgeable about BIM (Puolitaival & Forsythe, 2016).

This has been recognised internationally and many governments have established BIM as a necessary requirement (Zeiss, 2013). This has created an urgent need for educators in the industry to train BIM-ready graduates in order to meet industry requirements globally (Rooney, 2014). Therefore, academic institutions can play an essential role in the overall success of BIM implementation (Camps, 2008).

This is further acknowledged in the research of Wong & Fan (2013) who recommended that more construction related degree programmes should incorporate BIM in their curriculum. In the United Kingdom (UK) the BIM Academic Forum (BAF) through its BIM Academic Framework assisted by sponsorship by the UK's Higher Education Academy (HEA) is co-ordinating the embedding of BIM in taught programmes.

II THE IMPORTANCE OF BIM TO QUANTITY SURVEYING AND COMMERCIAL MANAGEMENT

In quantity surveying the traditional methods of working and providing quantity surveying services will eventually become redundant and education, training and adoption of BIM will be the only way to ensure survival of the quantity surveying profession (Crowley, 2013). BIM will create radical changes to the quantity surveying role

necessitating learning new skills and new ways of working (Pittard & Sell, 2016). Therefore, it is important to develop a plan for bringing BIM into the curriculum (Adamu & Thorpe, 2016).
BIM allows the QS to gain significant time advantage in the quantification and calculation tasks providing additional time to perform new and enhanced QS services (Crowley, 2013). The research of of Pittard & Sell (2016) confirm this when they note that for the quantity surveyor BIM will foster innovation and enhance the existing services that they provide and develop new service streams to provide a wider portfolio.
BIM changes workflows and practices, improves productivity, brings cost efficiencies and allows the QS to add value to services (Crowley, 2013). BIM implementation in essence requires a change of attitude and mindset which includes a more open approach to collaboration (Pittard & Sell, 2016).

III THE NEED AND CHALLENGES TO EMBEDDING BIM IN QUANTITY SURVEYING PROGRAMMES

BIM is having a significant effect on higher education programmes and their accreditation. This has prompted the Royal Institution of Chartered Surveyors (RICS) to review their pathway guides to attaining professional membership which has necessitated reviewing degree programmes to incorporate BIM with core skills (Pittard & Sell, 2016). The research of Adamu & Thorpe (2016) observes that academics should be capable of embedding BIM in their modules. The main consideration is that BIM content needs to reflect current developments in working practices and organisational structures (Coulson-Thomas, 1989). Therefore, it is imperative to develop a plan for bringing BIM into the curriculum (Adamu & Thorpe, 2016). This was further developed in the research of Crowley (2013) who identified that the aim of embedding BIM into the curriculum should be to integrate BIM within existing education and worked based learning rather than to create an additional tier of qualification. This approach is also favoured in the research of Puolitaival & Forsythe (2016) who observed that there was some consensus in academic literature on an integrated approach that embedded BIM in existing courses.
However, the research of Abdirad & Dossick (2016) contradict this when they note that when it comes to including BIM in the curriculum, education literature provides limited guidance, except to identify the need for it to be industry informed. Therefore, there is a relative shortage of pedagogical literature and case studies about curriculum development and teaching experiences regarding BIM in UK higher education (Adamu & Thorpe, 2016).
With regard to the specific challenges to embedding BIM in the curriculum of construction-related programmes, Kymmell (2008) identified a lack of understanding of the BIM process. The lack of expertise amongst staff, up-skilling needs and the necessity of remaining current with a constantly evolving BIM environment were also identified as barriers to the implementation of educational BIM by Puolitaival & Forsythe (2016). Adamu & Thorpe (2016) also identify an inflexible or tight curriculum as a potential barrier. The research of Sacks & Pikas (2013) also identify a lack of competent BIM educators as a barrier for incorporating BIM. However, the research of Puolitaival & Forsythe (2016) noted that this may be as a result of staff being unwilling to change an existing curriculum in order to incorporate BIM.

IV BIM IMPLEMENTATION WITHIN THE BSc(Hons) QUANTITY SURVEYING & COMMERCIAL MANAGEMENT PROGRAMME AT ULSTER UNIVERSITY

In the first year of the programme at Ulster there is a focus on introducing BIM in the specific “BIM Fundamentals” module delivered in semester 2. This module develops an understanding of the key drivers and barriers to fully implementing Level 2 BIM and points towards the development of level 3 BIM working in the near future. The module also develops foundational skills in the application and use of BIM software such as Revit and Navisworks. The module is also delivered across a number of first year construction programmes illustrating the importance across specialisms and the influence of collaboration. This is an approach that is recommended in the research of Adamu & Thorpe (2016) in a case study where the first year focussed on fundamental principles and concepts of BIM, awareness and basic use of basic BIM technologies and appreciation of collaboration and interoperability issues.
Progressing into second year BIM has been embedded in the learning outcomes of a number of modules. This is an approach that Adamu & Thorpe (2016) have observed in their research creates advantages and opportunities to further embed and develop BIM learning. In the “Commercial Construction Measurement” module students are introduced to BIM measure and quantification and billing software for measuring and preparing descriptions in accordance with NRM2 for a variety of construction elements such

as substructures, structural frames, finishes etc. This is further embedded in the "Cost Planning & Design Value Economics" module where learners use BIM measure software to prepare cost plans and estimates in accordance with NRM1. The "Commercial Management" module also incorporates BIM learning using BIM technologies to assist in the preparation of estimates, construction programmes and cash-flow projections.

The module of "Procurement & Administration" outlines the increasing importance of BIM in the tendering process and the "Construction Contracts" module deals with the evolving implications of BIM contractually.

In third year the students are on industrial placement and exposure to BIM is very dependent upon the organisation with which they are placed. However, it is encouraging to note that an increasing number of students are involved in the use of BIM and that many are being involved in the BIM implementation process with their placement employer whilst others are becoming aware of the issues that are discouraging BIM adoption. This is also confirmed in the research of Adamu & Thorpe (2016) who observed in their case study that students on industrial placement are expected to appreciate industry needs and utilisation of BIM, hopefully improve their practical BIM skills and gain an awareness of the opportunities and barriers to BIM adoption.

As a final year student the learner will again be exposed to BIM across a number of modules. These include "Advanced Measurement" where are again learners use BIM software to quantify a variety of elements such as piling, pilecaps and ground beams, services, civil engineering structures etc. The "Construction Economics" module builds on the second year economics module and again uses BIM measure software to prepare cost plans, cost estimates and whole life costs. Moving on to a more strategic level the "Project Management" module examines the implications of BIM for the project manager in terms of managing and controlling a project to ensure it is delivered on time and on budget as well as the applicability of BIM during the operational phase of a structure. The "Quantity Surveying Project" module provides the opportunity to again use BIM software to produce costs estimates and address hypothetical issues or problems associated with BIM implementation and/or delivery through scenario based tasks. There is also the opportunity for a student to undertake a major piece of individual research on BIM through the "Research & Dissertation" module and there is an increasing number availing of this opportunity prompted by prior academic learning or experience gained on industrial placement.

This again reflects the case study research of Adamu & Thorpe (2016) who observed that in final year the acquiring of knowledge on the strategic delivery of BIM as well as its place within modern organisations gained prominence. The mixed approach at Ulster of having a stand-alone BIM module in first year with BIM integrated into the learning outcomes of existing modules in subsequent years is endorsed in the research of Clevenger et al. (2010) cited in Abdirad & Dossick (2016) who recommended combining these two strategies as students can learn about general BIM concepts and skills in a standalone module which then prepares them for more advanced BIM concepts and skills in updated modules.

The final year content and delivery also acknowledges that it is very important to find a balance between theory and practice and also technology and process (Puolitaival & Forsythe, 2016).

The commitment of the staff to further embedding and enhancing BIM learning on the undergraduate programme is evidenced by three lecturers and authors of this paper currently undertaking doctoral studies on BIM related areas. It is also important to note that all of the authors are working with the RICS and industry in Northern Ireland to produce research on BIM implementation and capabilities.

V FUTURE CHALLENGES TO THE DEVELOPMENT OF BIM WITHIN THE CURRICULUM

The necessity of remaining current with a constantly evolving BIM environment is a major challenge to the implementation of educational BIM generally (Puolitaival & Forsythe, 2016). Therefore, academics need to constantly re-appraise their BIM learning outcomes to ensure relevance to professional practices and to meet industry needs (Adamu & Thorpe, 2016). This necessitates active investigations of BIM curriculum developments internationally and the necessity of building close relationships to the local industry (Puolitaival & Forsythe, 2016).

This continuous evolvement of BIM obviously creates challenges such as that identified by Puolitaival & Forsythe (2016) with regard to the time required to create course resources which become quickly outdated. This was further developed in the research of Woo (2007) and Sacks & Pikas (2013) cited in Puolitaival & Forsythe, (2016) who reported that the challenge with resources was not their availability, but finding those most appropriate to the students'

level of experience and intended learning outcomes.

VI CONCLUSION

The future of BIM incorporation on the BSc(Hons) Quantity Surveying & Commercial Management programme at Ulster University requires research to investigate how BIM resources for educational purposes could be enhanced through collaboration in resource development with other institutes (Puolitaival & Forsythe, 2016)..

However, greater impact could be made if academia, industry and government worked together on BIM in order to achieve mutually beneficial goals (Adamu & Thorpe, 2016). This can be facilitated by the university in the role of a "transferrer" of knowledge in a more inclusive model of knowledge exchange (Hope, 2016).

There is also consensus amongst academia and industry on the need for financial, technological, and educational support from the industry to overcome the conservative and slow adoption of BIM education (Abdirad & Dossier, 2016).

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