# Developing a Collaborative Virtual Learning Environment Between Students Across Disciplines in the Built Environment

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# Developing a Collaborative Virtual Learning Environment between Students Across Disciplines in the Built Environment

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## Abstract

Integrated Project Delivery is a rapidly developing approach to Design and Construction.This approach uses business structures, new technologies, and newly developing practices to collaboratively utilise the talents and contributions of all participants in the Design and Construction process.This project replicated this approach by creating a collaborative project between the School of Construction and the School of Real Estate and Construction Economics. The term "collaborative learning" refers to a method of delivery in which students at various performance levels work together in small groups towards a common goal. The students were responsible for one another's learning as well as their own. There were a number of objectives of this collaborative project. Promoting interaction between students from different but related courses, was at the centre of the study. Allied to this was the need to enhance student's ability to think creatively, solve problems, and make decisions as a team. Additionally, it was important to evaluate the benefits of using a Virtual Learning Environment for teaching, learning and assessment and examine the benefits of Building Information Modelling (BIM) as a tool for feedback. This study used a qualitative methodology, using focus group interviews, reflective journals, and individual interviews to gather data. The study included sixty students from the two schools in question, who were divided into groups of four. The students worked together on a common project, collaborating to achieve a common goal.

There were a number of benefits to this project with an emphasis given to the interaction of the students. The collaborative learning approach provided a format for the students to interact, including: giving and receiving help; exchanging information and resources; giving and receiving feedback; challenging and encouraging each other; and jointly reflecting on progress. The other main benefit was in the use of a Virtual Learning Environment and associated technologies. The findings were that students were very supportive of using wikis. They enjoyed working with students from a different course, and found that working in a collaborative manner improved their learning. They were supportive of using 3D models and acknowledged the importance of BIM going forward. On the downside, they felt that timetabling within the two schools restricted the options for meeting. They also felt that formative feedback on a more regular basis would be helpful.

**Keywords:** Collaborative learning, Virtual Learning, Group work, Building Information Modelling

**Introduction**

The growth of IT and telecommunication services, social media use, and a shift to working and collaborating in an online "virtual" world  has changed the way we conduct business on a global scale (Hooper 2013). It has also been reported that the UK accommodates 7.6 million square metres of data-centre space, and estimated that £2.19bn will be invested in the UK on additional space of this nature during 2013 Hooper (2013). The scale of this investment illustrates the exponential growth of the digital world. The construction industry has embraced the concept of virtual working, acknowledging the attributes of cloud computing, and how new technologies in this area can benefit projects on the ground (Brown 2013).

The evolution of Building Information Modelling (BIM) internationally, and the collaborative nature of this process is intrinsically linked to the increasing interest among construction professionals in virtual platforms. This is reinforced by Pittard (2013, p.47), who advises that "using BIM requires a move away from the traditional workflow, where all parties – including architects, surveyors and contractors – work from separate information pools and use different, often incompatible software packages, to a situation where everyone effectively works on just one common information pool". This establishes the important link between collaboration, BIM, and the use of virtual environments in the construction industry going forward.

The idea for conducting this research study originated as a result of the decision in 2011 by Dublin Institute of Technology (DIT) to amalgamate the School of Construction and the School of Real Estate and Construction Economics, into a new entity as part of a new college structure. The authors considered that this development was an ideal juncture to conduct a research study involving students from both schools, collaborating in a proactive manner.

Anecdotally, it was felt that while DIT provided many different courses relating to the wide spectrum of professions engaged in the construction process, there was a deficiency in collaboration between these courses. This was in direct contrast to the reality of the construction industry, where architects, surveyors and engineers work together on a daily basis. The concept of this study was to provide a platform to engage students from various construction disciplines to participate in a process which mirrors the workplace experience.

Bouchlaghem (2012, p.1) has argued that "Complications arising from poor collaboration are the source of a variety of the construction industry's biggest problems". It is now widely recognised that an effective collaboration strategy based on the implementation of information systems and careful consideration of the wider organisational issues are the key to delivering construction projects successfully (Watson, 2013). Bouchlaghem (2012, p.7) defines collaboration in construction as "an activity in which a shared task is achievable only when the collective resources of a team are assembled. Contributions to the work are coordinated through communications and the sharing of information and knowledge." This emphasises the team aspect of construction project delivery, and the importance of strong communications between the team members. These themes are inherent in this study, the organisation of students into functioning teams, and the facilitation of good communication between team members by utilising PBworks.

**Context of the Study**

Our construction practices and procedures are subject to a rapidly evolving information technology sector, enhanced by worldwide advances in communications technology. These technologies are providing construction professionals with the tools to implement new collaborative strategies (Hooper, 2013). Any given construction project involves the collaboration, at some level between Architects, Engineers, Quantity Surveyors, Project

Managers, and many other construction professionals, depending on the magnitude and complexity of that project. Much of this process is based on a traditional sequential approach in which many of the participants often work independently, make decisions that inevitably affect others and then come together in face to face meetings. As educators, we believe we must equip students with the skills and knowledge to prepare them for an industry so dependent on collaboration. Dublin Institute of Technology delivers a comprehensive list of construction related courses, which are recognised worldwide for the quality of their graduates. Yet the authors have found very little evidence of interaction between these courses. The existence of many construction courses being delivered under the same roof facilitates the potential for interlinked projects between students on these courses, providing cross course collaboration at a level comparable with that experienced by construction professionals in industry. This research aims to address this shortfall, and sets the stage for more deliberate, planned collaboration in the future.

**Collaborative Project-based Learning in Construction**

The teaching delivery strategies relating to both courses taking part in this study includes traditional lectures supplemented by tutorials. Blight (2000) reinforces that lecturing is still the most common method of delivery in higher education despite advances in new technologies. This paper does not advocate radical changes to our current modus operandi of delivery on these courses-; however it supports enhancement of the traditional approach through collaborative project-based learning. This collaborative project blends project collaboration with technologies. Bouchlaghem (2012) advises that much of the recent development on collaborative working in the construction industry has focused on the delivery of technological solutions, concentrating on the web. This has been introduced as a central component of this project by tasking students with the creation of web platforms via a

wiki environment, PBworks. This can facilitate a high level of interaction between students, who may be already comfortable with using more socially based web platforms in their social lives such as facebook, myspace, twitter, linkedin, etc. It can also familiarise students with current learning technology media and tools, and potentially creates a spirit of innovation which is currently demanded by employers in industry. Macfarlene (2004) advises that our courses must endeavour to introduce real life situations or problems into our content, to prepare students with the challenges that await them in industry. There are a number of downsides to using wikis as a means of collaboration. By their nature there is a faceless aspect to these technologies, reinforced recently by articles criticising social media. Waters (2013, p.5) discusses the "disproportionate venom of online commentary", and this is echoed by O'Connell (2013) who is concerned about the lack of legislation protecting individuals against misuse of these technologies. Although these comments relate to the utilisation of wiki's within a different context, these problems could also surface within a workplace environment. There are also concerns expressed by Biggs (2003) who warns that the adoption of teaching methods facilitated by new technologies are not the panacea for all deficiencies in this area.

A common theme which permeates this project relates to common skills essential for both disciplines, and how students from each discipline can benefit from interaction with each other. Pickens & Jagger (2005) describes the function of measurement carried out by Quantity Surveyors as the process concerned with converting construction drawings into words and numbers in accordance with a strict set of rules. The same terminology could be used when describing the Construction Managers role when producing a programme of works or schedule for any given project. Both disciplines require a number of holistic skills, which are not technical in nature such as: patience, accuracy and initiative. It is argued that these skills

can only be attained through practical project work, and the completed tasks can help students become more proficient in these areas.

The strategy adopted for this study involved ongoing interaction between students from the two chosen courses for the duration of one semester. There were sixty students participating in total, broken down into groups of four. An initial briefing session was organised during week 2 of Semester 1, where students met face to face for the first time. This initial meeting included the distribution of project tasks, along with an in-depth briefing of the project requirements. The students were then expected to organise meetings between themselves, where necessary, while simultaneously communicating via PBworks. The authors also communicated with the participating students via PBworks, offering formative feedback as the project progressed.

**Collaborative Project Assessment**

Hamlin & Szorenyi-Reischl (2006) advise that assessment strategies must be developed which are valid and reliable, and guide students towards desired approaches to learning. This was critical when developing the assessment strategy for this collaborative project. The assessment is designed to give both Quantity Surveying students and Construction Management students a manageable set of tasks that will facilitate collaboration and promote critical thinking. Students were furnished with a set of drawings of a real life project from which they were expected to complete a number of tasks, each task has been designed to ensure that the students must interact with each other and work in a collaborative manner – the skillsets from students on both courses were required to successfully complete the tasks, fostering group work and interaction. The students were encouraged to propose alternative designs, and not take the drawings at face value. This allows the student to think critically

about the design of the building, and recommend any changes to the current design. The students were encouraged to examine the constructability of the project and were expected to propose alternative construction techniques that would improve the efficiency of the build process.

Once the students became familiar with all the drawings and the project specification, the tasks were agreed with the students with a number of submission dates spaced over the two semesters on which the project runs. The students were split into groups, with two students from the Construction Management Programme and two students from the Quantity Surveying programme in each group. Once the students were familiar with each other and with the project drawings they were required to develop a VLE, this would take the form of a custom-built platform on PBworks.. All their work was submitted through this platform and feedback was given through the VLE also. For the Construction Management students the project assessment accounted for 50% of their AutoCAD module and 30% of their Construction Technology module; for the Quantity Surveying student, it accounted for 50% of their AutoCAD module and 30% of their Quantity surveying module. For this reason it was essential that the tasks assigned to the groups encompassed the learning outcomes of all relevant modules.

**Virtual Collaborative Learning Environment**

Despite the enthusiasm for digital technologies, and the fact that wikis and blogs have existed for over a decade, their use is relatively new in academia (Clarke, 2002). It should however be noted that it is a very fast growing area within higher education since 1998 (Clarke, 2002). On previous projects in the school when blogs have been used as part of the assessment strategy,

anecdotally and in the post module surveys, the feedback from the students has generally been very positive. Students have tended to be very innovative in their use of blogs in areas of design and links, and have interfaced different software into their blogs, utilising CAD, Buildsoft, and Revit. It has also been observed that the computer skills of students who were involved in writing the blogs were significantly improved compared to students from previous years who were not involved in blog usages.

The students were given a tutorial on how to create and manage all the material through PBworks at the start of the semester. This was the medium for the delivery of all assessment and feedback, PBworks (http://pbworks.com/). In deciding on the most suitable web tool to use for this project there were a number of considerations that needed to be taken into account such as accessibility, ability to upload documents, cost, ease of use, ability to create individual design and security. There are many different web tools available online that meet many of our requirements such as Google Blogger, Dropbox and Google+, but PBworks was selected for its collaborative enhancing properties such as allowing students to upload and comment on any uploaded documents. The tutor created a section for feedback and uploaded sample answers (see Figure 1). PBworks also allowed the students to personalise their site and to create an online portfolio that could be useful in future career applications. The tutor also uploaded a Revit Model of the building used in the project (see Figure 2). This three dimensional BIM model served as a feedback tool. These images create a visualisation of a building through the various stages of design, construction and occupational life which are displayed in real-time mode (Towey, 2012). Towey (2012) also advises that BIM benefits the Construction Industry because it improves communication and is collaborative and reliable.
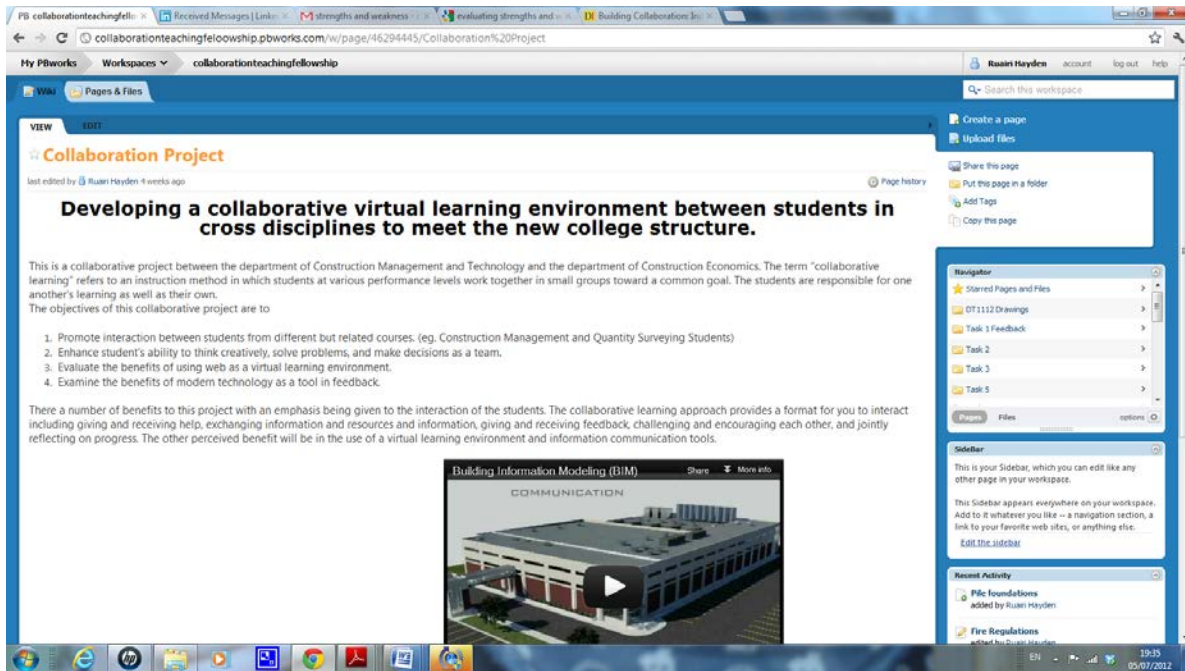
Figure 1 Tutors PBworks Wiki Page



Figure 2 Revit Model of Project Building used for Feedback

**Building Information Modelling and Collaboration**

The construction industry has witnessed significant advances in the information and

communications technology sector over the last fifteen years, across all associated professions

(Towey, 2012). The push towards more expedient production of drawings, specifications, bills of quantities etc, has encouraged the various construction professions to invest in software and technology that can enhance their performance to achieve ever more ambitious deadlines. Client requirements are demanding closer collaboration between construction professions to simplify information flows, and reduce delays in production. This will also reduce opportunities for contractors to pursue financial claims. The idea of collaboration is a central theme in the philosophy that supports the growing phenomena that is Building Information Modelling within the industry. The rapid evolution of BIM within the industry is testament to the fact that clients are now expecting construction professionals to be fully educated and fluent in the application of BIM techniques. As a result, graduates from construction related courses are expected to have been exposed to BIM related technologies during their studies, and this can be a major factor when seeking employment after graduation. Although DIT has recognised the rising importance of BIM within the industry, and is in the process of developing new courses and modules to address this déficit,- there is a lack of content in this area among the current suite of modules on our construction courses. If true collaboration is desired within the institute, BIM technology will need to become a reality on all construction related modules. The authors considered that the introduction of BIM into this Project as a feedback tool was a forward step in the evolution of this technology within the Institute.

**Methodology**

Crotty (1998, p.3) has defined methodology as "the strategy, plan of action, process or design lying behind the choice and use of particular methods and linking the choice and use of methods to the desired outcomes". Opie (2004) views this as a process whereby the best approach is established to gather evidence in order to answer a particular research question.

Moustakas (1994, p.104) has argued in the context of educational research that"a method offers a systematic way of accomplishing something orderly or disciplined, with care or rigor". This study has adopted a qualitative research methodology, using focus group interviews to collect data. The authors considered that a qualitative approach would deliver quality data, with focus group interviews providing an opportunity to rigorouly discuss this data. Gillham (2000) advises that interviews are more than a conversation; they must be formal, have a research agenda, and are subject to some form of control. He argues that they are appropriate where a relatively select number of individuals are involved, and are accessible to be interviewed. Gillham (2000) discusses the advantages of interviews in that they are effective in collecting expert opinion, and that information produced can be rich in quality and vividness. Barbour & Kitzinger (1999) suggest that focus groups were initially embraced enthusiastically by market researchers, however are becoming increasingly popular in many areas of research, especially in the political arena. Morgan (1993) recommends that the design of a focus group interview requires careful thought and reflection, and the design will depend on its purpose.The group of students involved in this study was confined to second year students on both the undergraduate courses in Construction Management and Construction Economics. It was important that the students were free to offer opinions on their experiences on the Project. Puchta & Potter (2004) inform that focus groups facilitate people in giving their views in their own ways, and in their own words. From the outset of the study, clarity was sought on what concepts required investigation, and what participants would be targeted. Morgan (1993) reported that analysis of gathered information is the most challenging aspect of focus group research, and that a considerable amount of subjective judgement is necessary for a successful outcome. He further advises that the data must be organised and subdivided into meaningful segments for analysis, whereby meaningful

conclusions can be obtained.The results arising from this methodology are explored in the following Project Evaluation section of this paper.

**Project Evaluation and Discussion**

The evaluation strategy for this project was twofold; the first element of the evaluation involved obtaining feedback from the students. Biggs (2003) advises on the importance of pedagogic methods having a student centered approach, and the role student feedback plays in developing future teaching practice. To ensure that all students participated in this process they were set a personal reflection task which accounted for 5% of the overall assessment mark for the project. Their personal reflection of the project was to include the following components:

- Their reaction to the collaboration project as a whole. Biggs (2003) advises that student feedback on their experiences of a particular teaching method should be used to shape future practice.

- How their interaction with students from other courses improved their learning. Race (2001) informs us about the shared learning experience. Reece & Walker (2005) advise that students are likely to work in small groups in industry, and we have an obligation to use these approaches in a controlled environment.

- How they felt the use of a virtual learning tool (the wiki) improved their overall learning during this project. Clarke (2002) argues that online resources are being utilised more frequently as teaching tools, and this study has included this aspect as an important component within the study.

- Their thoughts on the use of a 3D model as a feedback tool. Towey (2012) confirms that the visualisation aspects of 3D models assists students when working on construction projects.

- How they felt the project should be improved. Macfarlane (2004) advises that lecturers should continuously reflect on their pedagogic approach. The authors considered student views on the project to be a critical influence on future practice.

The students compiled this feedback in report form which was uploaded on PBworks. The students were then invited to attend a two hour focus group interview where they could expand on these views, and elaborate as they wished. Students were given the opportunity to air their opinions in a free and open environment – each student was asked to make a contribution, and could decline if they did not want to participate; this facilitated an informal atmosphere. The data arising from the student feedback contained in their personal reflections was analysed and compiled into charts, representing the levels of their enthusiasm or criticism under the first four areas listed above.

The reflective journal compiled and uploaded by the students served as the blueprints for organising the data into the main themes listed above. The focus groups were used to flesh out the responses already given and to assist with clarification where necessary. . Creswell (2007) discusses the importance of identifying significant statements that explain the experience of the situation and emphasises drawing out key themes to produce rich descriptions. The authors divided the data into divisions ranging from *poor* to *excellent*. The students had been informed of this method prior to completing their reflective journals, and were asked to link their responses back to this scale. This facilitated the authors when analysing the data.
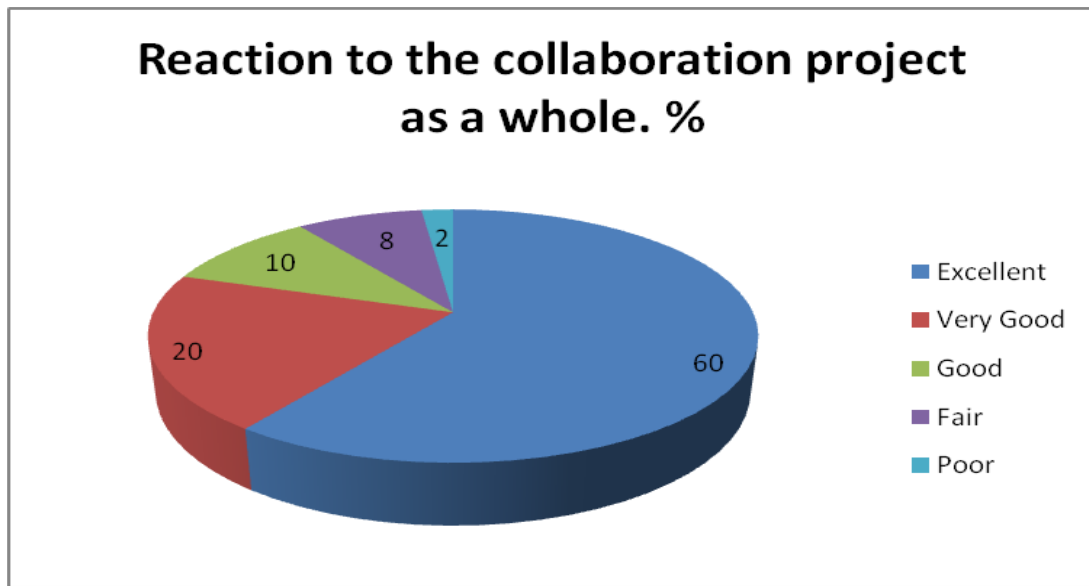
Figure 3 Student Reaction to the Collaboration Project

Figure 3 illustrates a very positive sentiment towards the project as a whole with only 10% of students finding the project only *fair* or *weak*. These findings strongly support the retention of this form of project for both courses in the coming academic year. Students reported that they enjoyed working with peers from other related courses. It gave them a taste of the collaborative environment which exists in industry where many different construction professionals work together on a daily basis. Students generally recognised the benefits of collaboration with other Construction courses, as there are many commonalities between the topics and subject matter studied on these courses. Over 90% of students expressed a positive attitude towards the concept of collaboration. Reece & Walker (2005) are supportive of group work and this illustrates an appetite among students to participate. The only negatives were the logistical problems associated with organising meetings due to timetabling constraints. Many students were unwilling to be present in the college at times where no lectures were scheduled for their particular course. They felt that timetables should have been organised in a manner to facilitate meetings between the students on both courses. This supports Macfarlane (2004) who insists that a student centered approach must be adopted at all times, and

timeables must be designed to suit students. This is an area which could be improved upon when facilitating this project next semester.

The Irish Construction industry is currently experiencing major technological changes with the introduction of BIM, which facilitates a collaborative approach to Construction, and has an impact on all Construction professionals into the future. The introduction of BIM into modules on Construction courses is still at an embryonic stage, which will experience rapid advancement over the coming years (Hore, 2010). The positive sentiment recorded on this project by students towards collaboration sets the scene for future projects of this nature, which will become a necessity, especially in the context of BIM in the future.
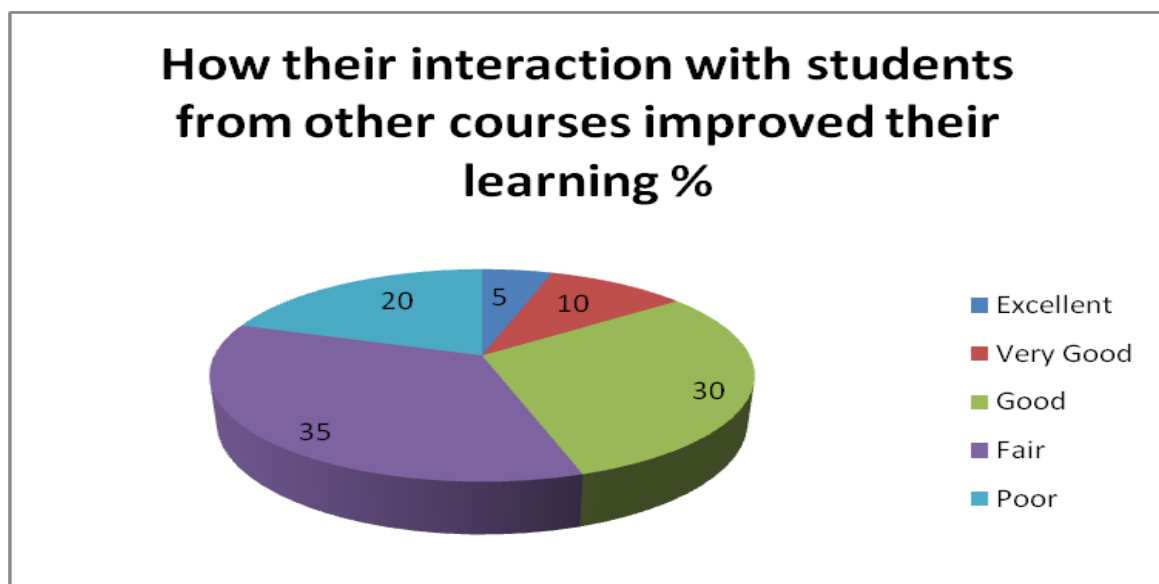


Figure 4 How Interaction with Students from Other Courses Improved Learning

Figure 4 illustrates a breakdown of student opinion on how interaction actually worked in the projects. The students reported enjoying the interactive concept, which they felt mirrored the Construction workplace where many different professionals must work together as a coherent team in order to deliver a completed project. The merits of work placement as an educational

approach are becoming more acknowledged throughout the higher education sector (Boud & Soloman, 2001), and this study reinforces the student appetite for experience of this kind. They recognised the importance of group work, and considered that this would be a major part of their working life in the future. There was mixed reaction to how this worked on this particular project, with only 15% of students rating the experience as *very good* or *excellent*. 55% of students found this is only *fair* or *poor*, and this is an issue which will require attention before this project is used again. The main criticisms surrounded two main areas: firstly, students on all groups tended to complete tasks that fell within their comfort zone, i.e. Quantity Surveying students completed the measurement tasks, while Management students carried out CAD and design tasks. There was no incentive for students to work on tasks outside their field which stunted interaction. Blanchard (2009) advises that students must be challeneged by taking them out of their comfort zone, and this aspect will be considered carefully by the authors on future projects. Secondly, students complained that the project was not facilitated by coordinating timetables, i.e. common times scheduled for students from both courses to meet in the presence of lecturers. There were also complaints which are experienced on all projects where there is a group work element involved such as: certain students not completing a fair share of the workload, students not engaging, personality clashes, and problems of that nature. Blanchard (2009) advises that group work must be monitored carefully to ensure participation from all group members.

These criticisms can be easily addressed in the coming academic year by the lecturers involved in the collaborative project. With the help of Department Heads on both courses, timetables for these modules can be synchronized, which will facilitate interaction between students for meetings and assistance from lecturers. Many students also felt that lecturers should play a more pivotal role with regards to delegation of tasks.

Students were very positive with regards to PBworks as an interactive collaborative platform. They enjoyed this aspect of the project, and were comfortable with regards to uploading work, and leaving comments on the open page forum. They felt that this was a novel approach to learning not present on any other modules. This supports Russell (2010) who finds that students embrace new online technologies, and is a very positive aspect of this study.
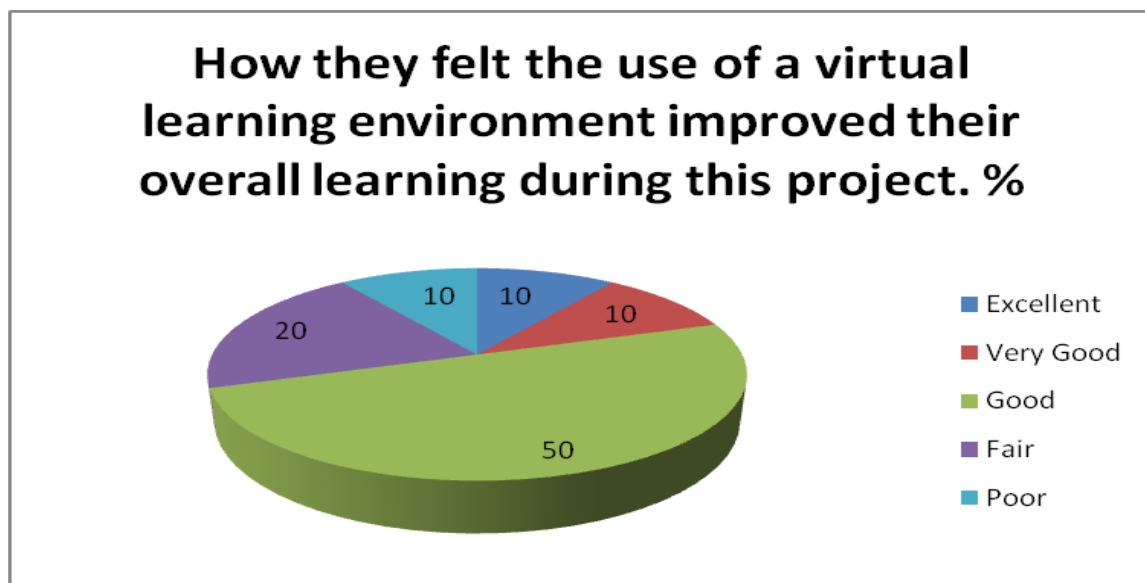


Figure 5 Improvements in Overall Learning

Figure 5 demonstrates how using a wiki improved the overall learning experience for students. This was generally well received by students, who are used to using Facebook, Twitter , blogs and social media tools in their social lives. Students were very supportive of this tool with 70% of responses in the *good* to *excellent* category. Six students expressed their concerns relating to posting negative comments on the web platform. Twenty two students advised that texting or email was a more practical method of communication. There were also criticisms relating to lack of lecturer activity on the platform, with a deficiency on their part with regard to comments and advice. Biggs (2003) informs that formative feedback is very important for students, who require continuous structured advice. Waters (2013) gives a

detailed insight into negative comments online. The tutors have considered these comments, and will focus on more frequent feedback on future projects. Also, students will be encouraged in future to upload commentary, even if negative in content, so long as inappropriate content is not included.
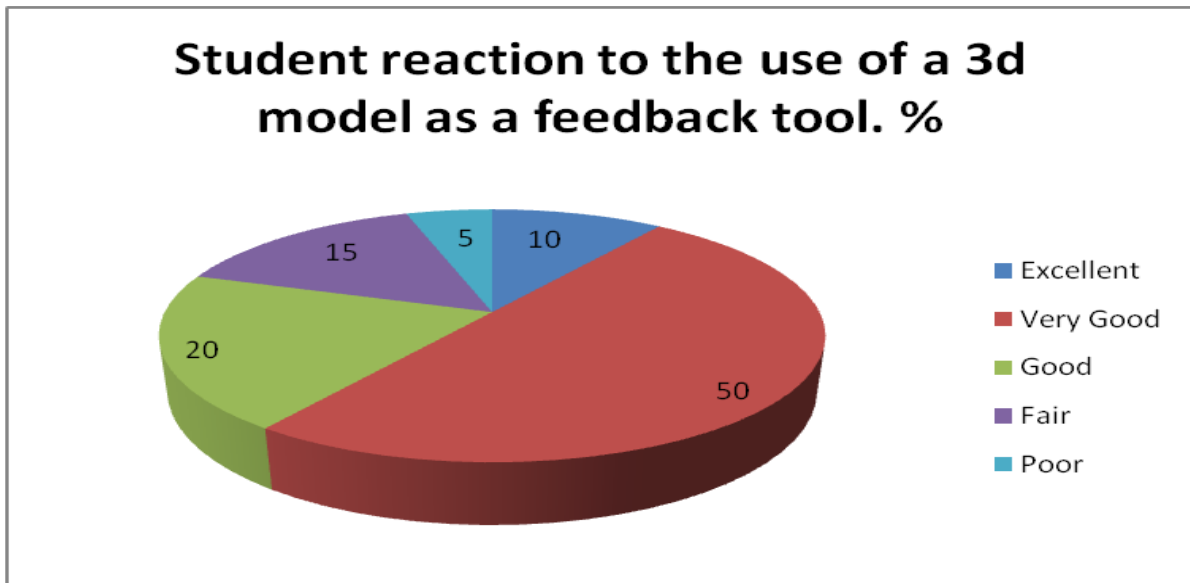


Figure 6 Student Reaction to the Use of a 3D Model as a Feedback Tool

Figure 6 depicts a strong student sentiment towards the use of a 3D model as a feedback tool, and this was evident especially among the Quantity Surveying students who found the model very beneficial when reviewing measurement tasks. 80% of students expressed comments in the *good* to *excellent* category, which is very positive especially in light of advances in BIM which is the main area of technological advance in our industry at present. Students felt that the model aided them when trying to visualise 2D drawings. Towey (2012) advises that the evolution of BIM technologies in the Construction Industry is now at an advanced level. The benefits of these technologies have been explored above, and are reinforced by the result of this study.

Students expressed many opinions relating to how the project could be improved, and these suggestions were generally in line with the responses illustrated in the above charts. The student suggestions have been summarised into four main points:

- Lecturers to provide more regular feedback as tasks are completed, offering advice on where improvements can be made.

- Timetables relating to modules on both courses to be synchronised in the future to facilitate meetings and face-to-face group work.

- Reduce the number of tasks, and include lecturer involvement with regard to delegation of workload.

- Marking scheme should be more reflective of the work involved with each task.

A second evaluation strategy will examine future student's results with the students from this year's project, and will explore what effect the future work and recommendations will have on the students learning. This will be carried out over the next two years, by using projects similar in nature, and with the same group of students. This is a long term strategy that can produce data to inform the thinking, planning and development of a collaborative framework between the Schools into the future. This will inform practice in the future; Biggs (2003) proposes the continuous reassessment of pedagogic approaches, and recommends that lecturers should reflect on past practice.

**Conclusion**

With the advances in technology available in higher education and the changing methods of communications, this study has shown that the use of a suitable virtual learning tool and the collaborative learning environment it supports, has enhanced the student's experience. This helps ensure that the methods being used are current for the profession. The use of a virtual

tool such as a wiki has increased the skill level, confidence and productivity of the students across these two courses, and has allowed for a greater level of collaboration between group members. The tool selected (PBworks) was deemed to be appropriate for supporting a collaborative project, and had benefits that other online resources did not easily facilitate; however the new version of Blackboard recently introduced in the DIT would be considered if it meets all the requirements for future projects.

In an attempt to reflect the Built Environment in an academic setting, this project has developed a model for collaborative learning and teaching among student from different disciplines. This model is designed to help Built Environment academics develop programmes that will reflect real life projects. The model addresses the module delivery, the assessment method, group work and the benefits of a virtual tool in collaboration projects. The model may be used in any area of Built Environment education, and allows academics to analyse the benefits of using such a model. The introduction of a collaborative project can enhance the profile of the courses it is being delivered to and help attract the most competent and ambitious student and, this is turn may help in student retention.

This study highlights the increasing appetite that students have in relation to new technologies, especially in the learning technology domain. The increasing usage of social media tools in everyday life can act as an accelerant with regard to student expectations on how modules are delivered. The evolution of Building Information Modelling within the Construction industry must be embraced by academic institutions offering construction courses, which necessitates collaboration as an underlying philosophy, and also the necessity for encouraging computer literate graduates.

**Future Work and Recommendations**

The collaboration project will run again for the next academic year with many of the developmental aspects of the evaluation being incorporated into the project. The students will be given more time at the start of the modules to familiarise themselves with the wiki and also with their fellow group members. It is also clear from the student feedback that time needs to be set aside for the students to meet under the guidance of the tutors. This will be implemented next year and its benefits will be monitored on an on-going basis. The intention of this project is to eventually bring more Construction disciplines together to work on a common project. This current study will set out good practice guidelines that could be incorporated into any number of programmes or modules.

The emergence of BIM in the Construction industry is an important development that needs to be recognised by the DIT. This study recognises this and will incorporate more BIM and the use of Autodesk Revit in future projects. This would encourage other disciplines within the DIT to become involved, with the potential to see all the Construction disciplines working together on one model to deliver the different learning outcomes of their courses. This would ideally be co-ordinated through a project leader who would co-ordinate all the disciplines to achieve the final goal. The future will demand professionals with BIM skills, in order to achieve this, and the DIT will require support and resources form industry in developing and implementing BIM-based education.

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